

A revision of the genus *Deltote* R. L. and its allied
genera from Japan and Taiwan (Lepidoptera:
Noctuidae; Acontiinae)

Part 2. Systematics of the genus
Deltote R. L. and its allied genera

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Abstract Thirty-five species* of Japanese and Formosan Noctuid moths belonging to *Deltote* and its allied genera of Acontiinae are revised together with two European and North American species. Three new species, i. e., *Protodeltote inexpectata*, *Sugia rufa* and *Neustrotia rectilineata* are described. Inferred intrageneric phylogenetic relationships are discussed for most genera.

Contents

1. Genus <i>Protodeltote</i> UEDA.....	3
1-1. <i>P. pygarga</i> (HUFNAGEL)	3
1-2. <i>P. wiscotti</i> (STAUDINGER)	5
1-3. <i>P. distinguenda</i> (STAUDINGER)	8
1-4. <i>P. inexpectata</i> sp. nov.....	11
1-5. Phylogenetic relationships in the genus <i>Protodeltote</i>	14
2. Genus <i>Pseudodeltote</i> UEDA	15
2-1. <i>P. brunnea</i> (LEECH).....	15
2-2. <i>P. coenia</i> (SWINHOE)	17
2-3. <i>P. subcoenia</i> (WILEMAN and SOUTH)	20
2-4. <i>P. formosana</i> (HAMPSON)	24
2-5. Phylogenetic relationships in the genus <i>Pseudodeltote</i>	26
3. Genus <i>Micardia</i> BUTLER.....	28
3-1. <i>M. argentata</i> BUTLER.....	28
3-2. <i>M. pulchra</i> BUTLER	29

* Two species, i.e., *Neustrotia sugii* and *Pseudeustrotia candidula* are treated in this part in addition to 33 species of the part 1.

4. Genus <i>Koyaga</i> UEDA	32
4-1. <i>K. falsa</i> (BUTLER)	33
4-2. <i>K. numisma</i> (STAUDINGER)	35
4-3. <i>K. virescens</i> (SUGI)	38
4-4. <i>K. senex</i> (BUTLER)	41
4-5. <i>K. viriditincta</i> (WILEMAN)	44
4-6. Phylogenetic relationships in the genus <i>Koyaga</i>	47
5. Genus <i>Deltote</i> R. L.	47
5-1. <i>D. nemorum</i> (OBERTHÜR)	47
5-2. <i>D. uncula</i> (CLERK)	50
5-3. <i>D. bellicula</i> (HÜBNER)	51
5-4. <i>D. bankiana</i> (FABRICIUS)	53
5-5. <i>D. deceptor</i> (SCOPOLI)	54
5-6. Phylogenetic relationships in the genus <i>Deltote</i>	57
6. Genus <i>Sugia</i> UEDA	59
6-1. <i>S. idiosstygia</i> (SUGI)	59
6-2. <i>S. stygia</i> (BUTLER)	61
6-3. <i>S. elaeostygia</i> (SUGI)	64
6-4. <i>S. rufa</i> sp. nov.	67
6-5. <i>S. stygiodes</i> (SUGI)	69
6-6. Phylogenetic relationships in the genus <i>Sugia</i>	73
7. Genus <i>Neustrotia</i> SUGI	74
7-1. <i>N. japonica</i> (WARREN)	75
7-2. <i>N. costimacula</i> (OBERTHÜR)	76
7-3. <i>N. rectilineata</i> sp. nov.	78
7-4. <i>N. sugii</i> (TANAKA)	82
7-5. <i>N. noloides</i> (BUTLER)	85
7-6. Phylogenetic relationships in the genus <i>Neustrotia</i>	88
8. Genus <i>Pseudeustrotia</i> WARREN	89
8-1. <i>P. candidula</i> (DENIS and SCHIFFERMÜLLER)	89
9. Genus <i>Maliattha</i> WALKER	93
9-1. <i>M. signifera</i> (WALKER)	94
9-2. <i>M. rosacea</i> (LEECH)	96
9-3. <i>M. arefacta</i> (BUTLER)	98
9-4. <i>M. vialis</i> (MOORE)	101
9-5. <i>M. bella</i> (STAUDINGER)	104
9-6. <i>M. culta</i> (BUTLER)	107
9-7. Phylogenetic relationships in the genus <i>Maliattha</i>	110

The deposition of specimens is indicated as follows: ELKU Entomological

Laboratory of Kyushu University, Fukuoka, KMNH Kitakyushu Museum of Natural History, Kitakyushu, NSM Department of Zoology, National Science Museum, Tokyo.

1. Genus *Protodeltote* UEDA, 1984

Key to the species

Male

1. Process of sacculus broader, about 1/2 as wide as length of sacculus; harpe triangular and distinctly angulate dorsally 2
- Process of sacculus narrower, about 1/5–1/4 as wide as length of sacculus; harpe only weakly produced dorsally 3
2. Process of sacculus weakly tapering towards dentate dorsal margin; cucullus + harpe elongate, weakly expanded ventrally *pygarga*
- Process of sacculus dilating towards rounded dorsal margin; cucullus + harpe broad, much expanded ventrally *inexpectata* sp. nov.
3. Process of sacculus shorter, ending below costa; cucullus + harpe irregularly rugged ventrally, and more or less tapering distally *distinguenda*
- Process of sacculus longer, reaching to costa; cucullus + harpe smooth except for ventrodistal portion, and abruptly dilating distally *wiscotti*

Female

1. Posterior margin of copulatory cavity roundly produced in ventral view 2
- Posterior margin of copulatory cavity straight or concaved in ventral view 3
2. Posterior 2/3 of postmedial line sinuous; hind wing wholly suffused with brown *pygarga*
- Posterior 2/3 of postmedial line almost straight; hind wing white and irrorated with pale brown *wiscotti*
3. Posterior margin of copulatory cavity straight in ventral view; 7th abdominal sternum parallel-sided, with trapezoid distal portion *distinguenda*
- Posterior margin of copulatory cavity concaved; 7th abdominal sternum dilating posteriorly, with evenly and weakly rounded posterior margin *inexpectata* sp. nov.

1-1. *Protodeltote pygarga* (HUFNAGEL, 1766) (Figs. 9, 10, 28–D, E)

Phalaena pygarga HUFNAGEL, 1766, *Berl. Mag.* 3: 408.

Lithacodia fasciana: HAMPSON, 1910 (nec LINNAEUS, 1761), *Cat. Lepid. Phalaenae Br. Mus.* 10: 539.

Lithacodia pygarga: DURRANT, 1920, *Ent. Rec.* 32: 36.

Jaspidia pygarga: INOUE & SUGI, 1958, *Check List of the Lepidoptera of Japan* 5: 543.

Lithacodia pygarga: KARSHOLT & NIELSEN, 1976, *Systematisk fortegnelse over Danmarks sommerfugle*: 71.

Lithacodia pygarga: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 816, 2: 383, pl. 197: 32–36.

Length of fore wing: 11–13 mm.

Frons dark brown mixed with white; vertex ochreous; labial palpus dark brown and slightly tipped with ochreous on 2nd and 3rd segments; antenna dark brown ringed with white. Thorax dark brown, mixed with white; a broad transverse white band on the middle, sometimes indistinct; pleural area white. Fore leg dark brown mixed with white; fore tarsus banded with ochreous; mid and hind legs more whitish. Abdomen dark brown mixed with white and ochreous, and narrow white segmental lines; caudal portion of abdomen with ochreous tufts; dorsal crests dark brown and on 3rd to 5th segments.

Fore wing: Dark brown sparsely mixed with rufous, postmedial and terminal areas suffused with white except for costal area; subbasal line dark brown, indistinct, defined by white on outer side and waved from costa to vein 1; antemedial line indistinct, white, irregularly defined by dark brown on each side and minutely waved throughout its length; orbicular with white annulus and sometimes indistinct; claviform represented by moderately large white lunula, which is defined by dark brown on outer side; a large dark brown median shade; reniform with white annulus, constricted at the middle on outer side; postmedial line white, bent outwards below costa, then minutely waved, excurved to vein 4 and sinuous to inner margin; three white spots beyond postmedial line on costa; subterminal line white, defined on inner side by a dark brown patch on costal area, angled outwards at vein 7, excurved and minutely waved at the middle, sometimes indistinct below the middle because of white suffusion; a dark brown terminal series obsolescent towards tornus; basal 1/2 cilia fuscous mixed with white, and chequered with white and fuscous on apical 1/2.

Hind wing: Wholly suffused with brown; terminal line absent; cilia fuscous with an ochreous line basally through them, chequered with white and fuscous on apical 1/2.

Underside of fore wing: White irrorated with brown; costal area tinged with ochreous and rufous.

Underside of hind wing: White sparsely irrorated with brown; a brown discoidal spot and minutely waved postmedial line; the latter sometimes absent.

Male external genitalia: Tegumen moderately broad and separated into strongly sclerotized anterior portion and weakly sclerotized posterior portion; fenestrula large, well sclerotized and concaved medially; peniculus well developed; vinculum narrow and almost as deep as tegumen; saccus small, obliquely projecting dorsally and ended in a truncated tip. Uncus long, slender, falcate and sparsely short-haired. Valva rather short, 4 times as long as medially wide; costa moderately broad, obliquely declining distally; dorsal margin of harpe swollen and forming a small triangular ridge; cucullus + harpe elongate, almost 1/2 as long as valva, tapering ventrally to the middle, then weakly expanded ventrally, and ending apically in irregularly produced distal margin; cucullus + harpe weakly swollen on mediodistal surface; sacculus moderate in size, and dorsodistally with a large process, which is weakly tapering towards dentate dorsal margin. Juxta large, spade-shaped and weakly keeled ventromedially. Phallus long, curved dorsally before the zone and strongly curved ventrally beyond it; sclerotized portion of suprazonal sheath

broad and with dense serrations on its apical portion; deep and broad groove from the zone to posterior 1/3 of subzonal sheath; coecum very long, 1/2 as long as subzonal sheath; cornuti represented by moderately large central plate, left group of dense spinules on weakly sclerotized plate, and right group of much sparse, weak spinules.

Female terminalia: The posterolateral portion of 7th abdominal tergum with a large concaved area.

Female genitalia: Eighth abdominal tergum well sclerotized, and with weakly concave anterior margin; apophysis anterioris as long as 8th abdominal tergum; copulatory cavity large and deep; ventral portion of copulatory cavity well sclerotized, as long as 8th abdominal tergum and strongly dilating towards rounded posterior margin; a small pouch present at the end of copulatory cavity. Ductus bursae 1/2 as long as corpus bursae, and curved dorsally. Ductus seminalis almost as long as ductus bursae and bulged near vagina. Corpus bursae simple and long; cervix bursae short, 1/3 as long as corpus bursae. Signa absent. Papilla analis broad, sparsely short-haired and concaved at the distal margin; apophysis posterioris long, almost 2 times as long as apophysis anterioris.

Specimens examined: [Finland] 1 ♂, N. Helsingin pit., Nordsjo, 5. vi. 1960, A. AALTO leg. (KMNHIR000, 002); 1 ♂, Pellinge, 27. vi. 1940, NYLUND leg. (KMNHIR000, 003); 1 ♀, Trarvinne, date unknown, W. HACKMAN leg. (KMNHIR000, 004). [Denmark] 1 ♂, 13. vi. 1943, FJEDSKOV leg. (KMNHIR000, 005); 1 ♀, Røruig, Sicell, Oanmariz, 23. vi. 1962, S. LANGEMAR leg. (KMNHIR000, 006). [Korea] 1 ♀, Mt. Sudosan (700 m alt.), Kyongsangpuk-do, 9–12. vii. 1971, K. YAMAGISHI leg. (KMNHIR000, 007). [Taiwan] 2 ♀ ♀, Hotso, Nantou Hsien, 26–29. vi. 1973, M. OWADA leg. (KMNHIR000, 008–9). [Japan] 1 ♂, Kuzu Hot Spring, Nagano Pref., 2. viii. 1919, I. SUGITANI leg. (ELKU); 1 ♂, Naichi (300 m alt.), Wakayama Pref., 3. v. 1973, K. TOBI leg. (KMNHIR000, 010); 1 ♂, Mt. Hikosan, Fukuoka Pref., 12. v. 1975, K. UEDA et al. leg. (KMNHIR000, 011); 1 ♀, Mt. Kurodake, Ōita Pref., 10. vi. 1972, K. UEDA leg. (KMNHIR000, 012).

Distribution: Europe, USSR, China, Korea, Taiwan and Japan.

1–2. *Protodeltote wiscotti* (STAUDINGER, 1888)
(Figs., 30, 31, 86–A)

Erastria wiscotti STAUDINGER, 1888, *Stett. Ent. Zeit.* 49: 266.

Eustrotia wiskotti [sic]: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 576.

Micardia jezoensis SUGI, 1959, *Tinea* 5: 278, pl. 38, fig. 7.

Lithacodia wiscotti: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 816, 2: 383, pl. 197: 37–38.

Length of fore wing: 10–12.5 mm.

Head fuscous mixed with white and pale brown; labial palpus fuscous slightly tipped with white on 2nd and 3rd segments; antenna pale brown ringed with white. Thorax fuscous mixed with white; white band on the middle portion of thorax almost reduced; pleural area of thorax white; fore leg fuscous mixed with white; fore tarsus banded with white; mid and hind legs almost white and sparsely mixed with fuscous. Abdomen white

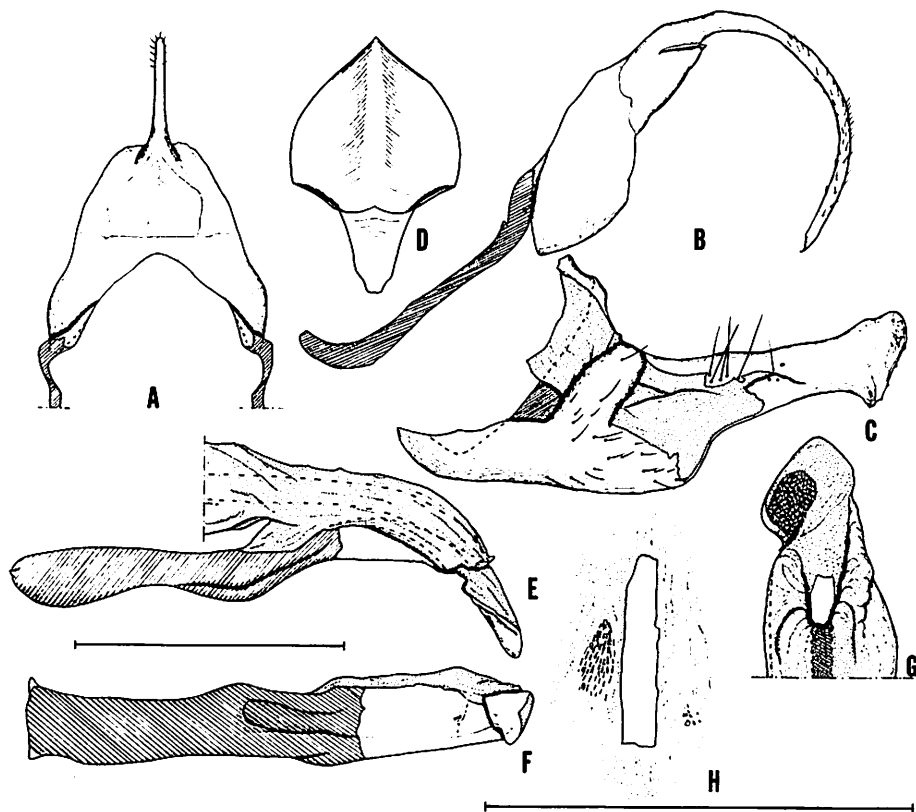


Fig. 30. Male external genitalia of *Protodeltote wiscolti* (STAUDINGER).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. G: Caudal portion of phallus in dorsal view. H: Cornuti. Scales 1 mm.

sparsely mixed with fuscous; dorsal crests absent.

Fore wing: Fuscous tinged with ochreous on costa, suffused with white below costa and postmedial area, and irrorated with rufous on median portion; subbasal line dark brown angled outwards to vein 1; antemedial line white defined by dark brown on each side, angled outwards to discoidal cell, then curved inwards and sinuous to inner margin; claviform and orbicular stigmata each with white lunula; reniform stigma with white 8 figure-shaped mark, which is open above and below; a dark brown median shade; postmedial line white slightly defined by fuscous on each side, strongly angled outwards from costa to vein 7, then interrupted by large dark brown shade from the outer side of reniform, and represented by almost straight white line from vein 5 to inner margin; in some specimens apical dark brown patch confluent with the dark brown shade from the outer side of reniform at vein 7; four ochreous spots beyond postmedial line on costa; subterminal line white, running almost parallel to termen; dark brown streaks on patches

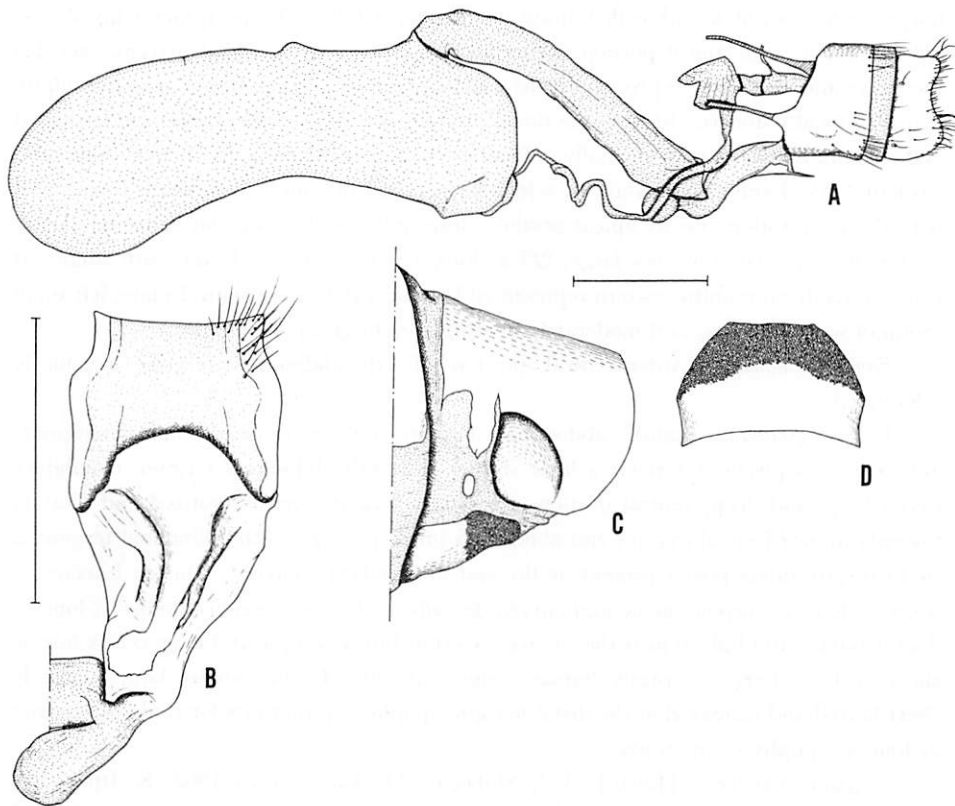


Fig. 31. Female genitalia and terminalia of *Protodeltote wiscottii* (STAUDINGER).
 A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scales 1 mm.

from termen below vein 5 and vein 2 to subterminal line; terminal series of dark brown striae indistinct; cilia fuscous mixed with white and with some dark brown at apex and middle.

Hind wing: White and irrorated with pale brown; a fine brown terminal line; cilia white mixed with fuscous.

Underside of fore wing: White irrorated with brown and ochreous.

Underside of hind wing: White sparsely irrorated with brown and rufous.

Male external genitalia: Tegumen moderately broad and separated into strongly sclerotized anterior portion and weakly sclerotized posterior portion; fenestrula large and with a weak dorsomedian longitudinal ridge; peniculus well developed; vinculum narrow and almost as deep as tegumen; saccus small, curved dorsally and ended in a truncated tip. Uncus long, slender, falcate and sparsely short-haired. Valva short, 3.5 times as long as medially wide; costa narrow and moderately declining distally; dorsal margin of

harpe slightly swollen and with minute denticles; cucullus + harpe rather long, $2/5$ as long as valva, with apical portion abruptly dilating towards its distal margin; sacculus moderate and with a large process on the middle of dorsal margin; the process irregularly dentate apically and reaching to the dorsal margin of costa. Juxta large, spade-shaped and longitudinally raised medially. Phallus long, curved dorsally before zone and strongly curved ventrally beyond it; sclerotized portion of suprazonal sheath broad, and with dense serrations on its apical portion; deep and broad groove on subzonal sheath before the zone; coecum very large, $2/3$ as long as subzonal sheath and with small flat ridge on its distal margin; cornuti represented by moderately large central plate, left small group of weak spinules, and moderately developed right group of spinules.

Female terminalia: Anteroventral portion of 7th abdominal tergum irregularly sclerotized.

Female genitalia: Eighth abdominal tergum well sclerotized and emarginate anteriorly; apophysis anterioris a little shorter than 8th abdominal tergum; copulatory cavity large and deep; ventral portion of copulatory cavity well sclerotized and dilating towards rounded distal margin and almost 1.5 times as long as 8th abdominal tergum; a small membranous pouch present at the end of copulatory cavity. Ductus bursae 0.7 times as long as corpus bursae and curved dorsally. Ductus seminalis almost as long as ductus bursae and bulged near the vagina. Corpus bursae simple and long; cervix bursae short, $1/4$ as long as corpus bursae. Signa absent. Papilla analis large, sparsely short-haired and concaved at the distal margin; apophysis posterioris long, almost 2 times as long as apophysis anterioris.

Specimens examined: [Japan] 1 ♂, Shibeche, Hokkaido, 5. vii. 1962, K. IJIMA leg. (SUGI Coll.); 1 ♂, Itakura, Gunma Pref., 18. vi. 1975, H. FUSE leg. (SUGI Coll.); 10 ♂♂ and 10 ♀♀, Arakawa, Fukuejima Is., Nagasaki Pref., 6. ix. 1974, Y. YOSHIYASU leg. (KMNHIR000, 013-32); 1 ♀, Shibeche, Hokkaido, 28. viii. 1964, K. IJIMA leg. (SUGI Coll.).

Distribution: USSR(Ussuri) and Japan.

1-3. *Protodeltote distinguenda* (STAUDINGER, 1888) (Figs., 32, 33, 86-B)

Erastria distinguenda STAUDINGER, 1888, *Stett. Ent. Zeit.* 49: 265.

Erastria fasciana: LEECH, 1900 (nec LINNAEUS, 1761), *Trans. Ent. Soc. Lond.* 1900: 140 (part).

Lithacodia distinguenda: HAMPSON, 1910, *Cat. Lepid. Phalaenae*. Br. Mus. 10: 542.

Jaspidia distinguenda: INOUE & SUGI, 1958, *Check List of the Lepidoptera of Japan* 5: 544.

Lithacodia distinguenda: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 816, 2: 383, pl. 197: 39-42.

Length of fore wing: 9-13 mm.

Frons white mixed with brown and rufous; vertex brown mixed with white and rufous; labial palpus dark brown mixed with ochreous and slightly tipped with white on 2nd and 3rd segments and white on basal portion of 1st segment; antenna dark brown

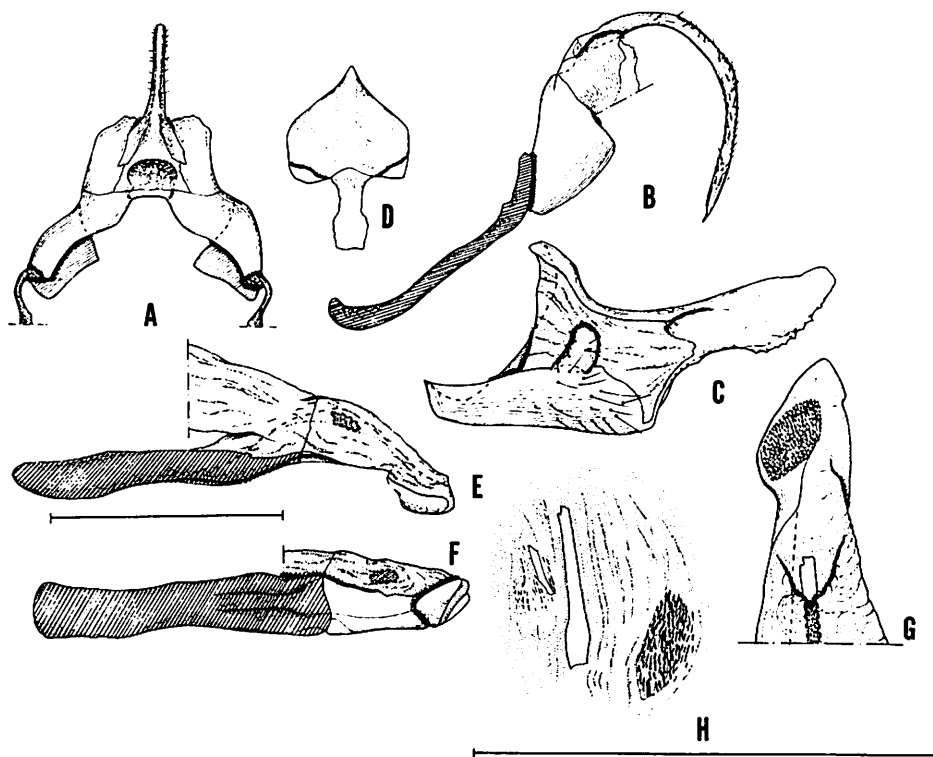


Fig. 32. Male external genitalia of *Protodeltote distinguenda* (STAUDINGER).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view. (left). F: Phallus in ventral view. G: Caudal portion of phallus in dorsal view. H: Cornuti. Scales 1 mm.

ringed with white. Thorax fuscous mixed with white, ochreous and sometimes tinged with rufous; white transverse band on the middle of thorax indistinct; pleural area fuscous to white; fore leg dark brown mixed with ochreous; fore tarsus banded with ochreous; mid and hind legs more ochreous. Abdomen fuscous mixed with white and with white segmental lines; caudal portion of abdomen sometimes more whitish and segmental lines indistinct; ventral portion of abdomen whitish; ochreous terminal tufts on male; dorsal crests on 3rd to 5th segments and dark brown.

Fore wing: Dark brown, irrorated with rufous; subbasal line indistinct, dark brown defined by white and running from costa to cell; antemedial line white, irregularly defined by dark brown on each side and minutely waved from costa to inner margin throughout its length; orbicular with incomplete white annulus; claviform large, with white lunula defined by a large dark brown shade on outer side; a large dark brown median shade between claviform and reniform; reniform with white annulus, which is constricted at the middle on outer side; sometimes this white annulus open below; an oblique waved dark

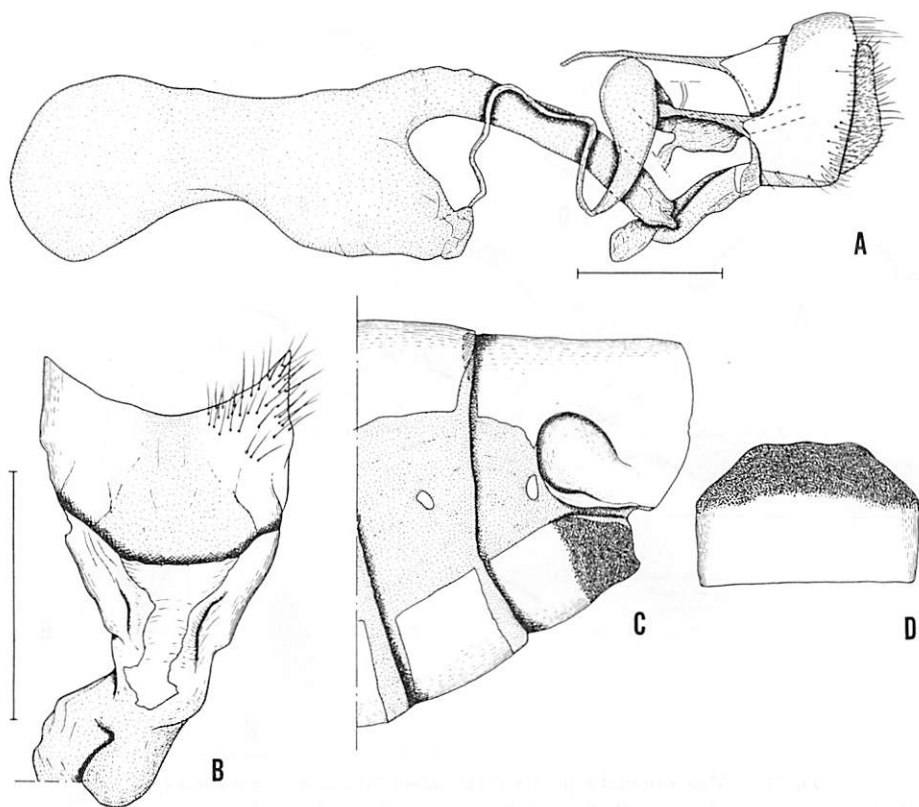


Fig. 33. Female genitalia and terminalia of *Protodeltote distinguenda* (STAUDINGER).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scales 1 mm.

brown line from lower angle of cell to inner margin; postmedial line white, defined by dark brown on each side, bent outwards below costa, then minutely waved, excurved to vein 4, and sinuous to inner margin; three ochreous costal spots beyond postmedial line; a large dark brown apical patch; postmedial area below apical patch dark brown mixed with white and rufous, and more whitish towards inner margin; subterminal line white, excurved below vein 7 and at the middle and angled inwards to inner margin; distinct terminal series of dark brown lunulae defined by white on inner side; the mark below vein 4 forming a short black streak; cilia fuscous basally, and chequered with white and fuscous distally.

Hind wing: White irrorated with brown; terminal line indistinct; cilia white with a fuscous line at the middle throughout outer margin.

Underside of fore wing: White irrorated with brown; costal area tinged with ochreous; terminal series dark brown.

Underside of hind wing: White moderately irrorated with brown; a brown discoidal spot and minutely waved postmedial line; terminal series dark brown.

Male external genitalia: Tegumen moderately broad and separated into strongly sclerotized anterior and weakly sclerotized posterior portions; fenestrula rather small and concaved medially; peniculus well developed; vinculum narrow, almost $4/5$ as deep as tegumen; saccus small, obliquely projecting dorsally and ending in a rounded tip. Uncus long, slender, falcate and sparsely short-haired. Valva rather short, 3 times as long as medially wide; costa narrow and moderately declining distally; dorsal margin of harpe slightly swollen and with minute denticles; cucullus + harpe slightly shorter than $1/2$ length of valva, irregularly rugged ventrally, and more or less tapering distally; sacculus moderate and with a short process on the middle of its dorsal margin, which is ending below costa. Juxta large, spade-shaped and longitudinally raised medially. Phallus long, weakly curved dorsally before the zone and gently curved ventrally beyond it; sclerotized portion of suprazonal sheath broad, with dense serrations on its apical portion; subzonal sheath with a deep and broad groove on its posterior $4/5$; cornuti represented by slender central plate, left plate bearing dense spinules and right group of sparse, short spinules including a small plate.

Female terminalia: Seventh abdominal sternum similar to that of *pygarga*.

Female genitalia: Eighth abdominal tergum well sclerotized, with straight anterior margin; apophysis anterioris as long as 8th abdominal tergum; copulatory cavity rather narrow, dilating towards its straight distal margin; a small membranous pouch present at the end of copulatory cavity. Ductus bursae $2/3$ as long as corpus bursae and curved dorsally. Ductus seminalis $2/3$ as long as ductus bursae and bulged near vagina. Corpus bursae simple and long; cervix bursae short, $1/4$ as long as corpus bursae. Signa absent. Papilla analis broad, densely short-haired and with straight distal margin; apophysis posterioris long, almost 2 times as long as apophysis anterioris.

Specimens examined: [Korea] 1 ♂ and 1 ♀, Mt. Sudosan (700 m alt.), Kyongsang-puk-do, 15–16. vii. 1971, K. YAMAGISHI leg. (KMNHIR000, 033–34). [Taiwan] 1 ♂ and 1 ♀, Mt. Shihtou-shan, Miaoli Hsien, 10. vi. 1975, K. UEDA and K. SETOYA leg. (KMNHIR000, 035–36). [Japan] 1 ♂ and 1 ♀, Ozino, Gifu Pref., 16. vi. 1976, H. ENDO leg. (KMNHIR000, 037–38); 1 ♂, Uodomenotaki, Sasagami Village, Niigata Pref., 25–26. vii. 1976, A. SEINO leg. (KMNHIR000, 039); 1 ♂, Mt. Wakasugi, Fukuoka Pref., 9. vi. 1972, K. UEDA leg. (KMNHIR000, 040).

Distribution: Korea, Taiwan and Japan.

1–4. *Protodeltote inexpectata* sp. nov.

(Figs., 34, 35, 86–C)

Length of fore wing: 10–12 mm.

Frons and vertex dark brown mixed with white; labial palpus dark brown mixed with white and tipped with white on 2nd and 3rd segments; antenna dark brown slightly ringed

with white. Thorax dark brown mixed with white; tegula with an indistinct white band at the middle; pleural area white; fore leg fuscous in front, mixed with white; fore tarsus banded with ochreous; mid and hind legs more ochreous. Abdomen fuscous mixed with white and with white segmental lines; ochreous tufts on the caudal portion of abdomen; dark brown dorsal crests on 3rd to 5th segments.

Fore wing: Dark brown sparsely mixed with white, fuscous and rufous; subbasal line dark brown, curved inwards from costa to vein 1; a narrow black streak along vein 1 from subbasal line to antemedial line; antemedial line white, defined by dark brown on each side, sinuous from costa to vein 1 and strongly curved outwards; orbicular and claviform each with white lunule; the latter is more distinct and larger than the former; a dark brown median shade irrorated with rufous; reniform stigma with white annulus, which is open above and below, and constricted at the middle; postmedial line white, defined by dark brown on inner side, angled outwards from costa to vein 7, then sinuous to vein 4

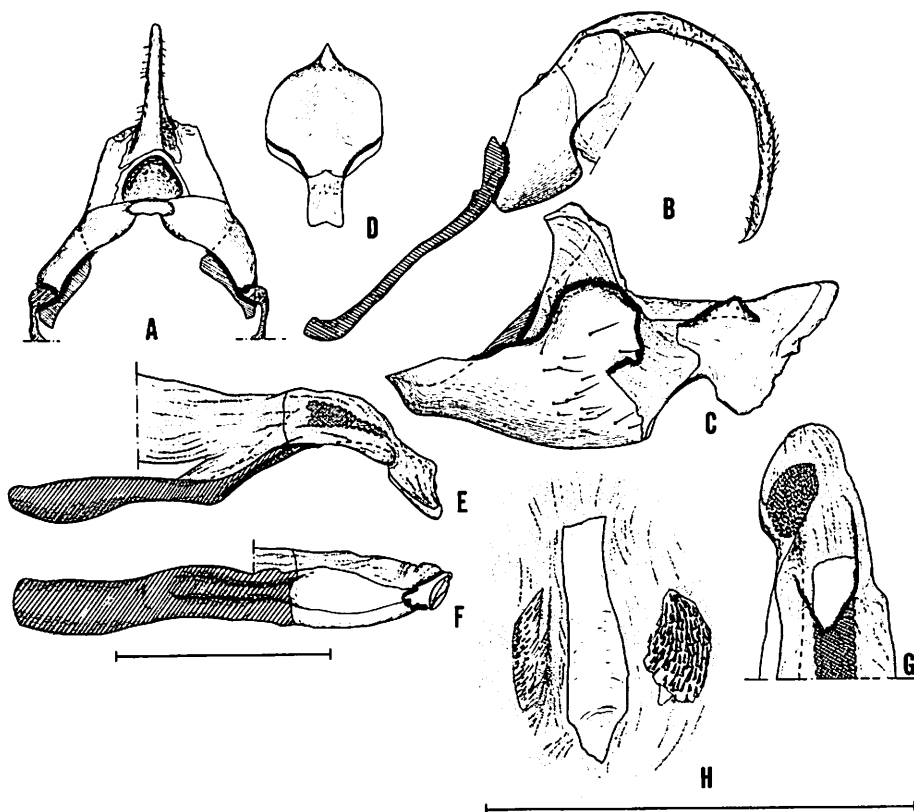


Fig. 34. Male external genitalia of *Protodeltote inexpectata* sp. nov.

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. G: Caudal portion of phallus in dorsal view. H: Cornuti. Scales 1 mm.

and curved inwards; four ochreous costal spots beyond postmedial line; apical patch indistinct, dark brown; postmedial area dark brown and suffused with white below vein 4; subterminal line white, sinuous and indistinct; the mark below vein 4 forming a short dark brown streak; a terminal series of brown lunules slightly defined by white on inner side; cilia fuscous mixed with white and with slender ochreous lines throughout its length.

Hind wing: Cupreous brown; terminal lines indistinct; cilia fuscous, with ochreous line on basal half throughout its length, and chequered with fuscous and white on apical half.

Underside of fore wing: White irrorated with dark brown; costal area slightly tinged with ochreous; terminal line dark brown and interrupted at veins.

Underside of hind wing: White sparsely irrorated with dark brown; dark brown discoidal spot and minutely waved postmedial line; terminal line dark brown and interrupted at veins.

Male external genitalia: Tegumen moderately broad and separated into strongly sclerotized anterior portion and weakly sclerotized posterior portion; fenestrula large, well sclerotized and broadly concaved medially; peniculus well developed; vinculum narrow and almost as deep as tegumen; saccus small, truncated. Uncus long, slender, falcate

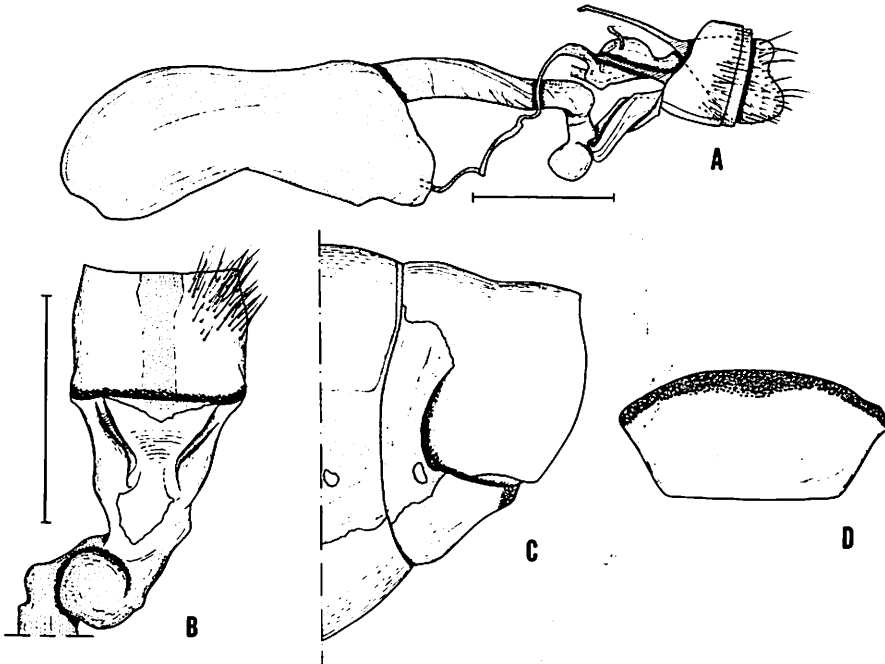


Fig. 35. Female genitalia and terminalia of *Protodeltote inexpectata* sp. nov.

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scales 1 mm.

and sparsely short-haired. Valva short, 3 times as long as medially wide; costa narrow, weakly angled subbasally, then strongly descending distally; dorsal margin of harpe moderately expanded, and forming a triangular process, the apex of which is slightly beyond the dorsal margin of valva; cucullus + harpe broad, 1/3 as long as valva and much expanded ventrally; sacculus moderate in size, and dorsodistally with a large and rounded process, which is dilating towards rounded dorsal margin. Jaxta large, spade-shaped and longitudinally raised medially. Phallus long, strongly curved dorsally before zone and curved ventrally beyond it; sclerotized portion of suprazonal sheath broad and dense serrations on its apical portion; subzonal sheath with deep and broad groove on its posterior 1/2; coecum very long, 1/2 as long as subzonal sheath; cornuti represented by very long central plate with acute proximal tip, left plate with rather dense short spinules, and right plate with weaker sparser spinules.

Female terminalia: Seventh abdominal sternum dilating towards rounded posterior margin.

Female genitalia: Eighth abdominal tergum well sclerotized, with incurved anterior margin; apophysis anterioris as long as 8th abdominal tergum; copulatory cavity rather narrow and shallow, and dilating towards concaved posterior margin; a small membranous pouch present at the end of copulatory cavity. Ductus bursae 2/3 as long as corpus bursae. Corpus bursae long; cervix bursae rather long, 1/3 as long as corpus bursae. Signa absent. Papilla analis broad and sparsely long-haired, and its distal margin concaved; apophysis posterioris long, almost 1.5 times as long as apophysis anterioris.

Holotype ♂, Mt. Kakuda, Niigata Pref., 9. vi. 1973, R. SATO leg. (KMNHIR000, 041).

Paratypes: 1 ♂, Mt. Koshida (265 m alt.), Awa Is., Niigata Pref., 8. viii. 1967, R. SATO leg. (KMNHIR000, 042); 2 ♂♂, Oyata, Gifu Pref., 28. viii. 1983, S. FUNAKOSHI leg. (KMNHIR000, 043-44); 1 ♂, Nagara, Gifu Pref., 12. vi. 1982, S. FUNAKOSHI leg. (KMNHIR000, 045); 2 ♂♂, Sanga, Fujiokatown, Aichi Pref., 18. v. 1972, B. TANAKA leg. (KMNHIR000, 046-47); 1 ♂, Jōkō-ji, Aichi Pref., 25. v. 1968, B. TANAKA leg. (KMNHIR000, 048); 1 ♂, Mt. Hikosan, Fukuoka Pref., 6. viii. 1972, K. UEDA leg. (KMNHIR000, 049); 1 ♀, Oyata, Gifu Pref., 28. viii. 1983, S. FUNAKOSHI leg. (KMNHIR000, 050); 3 ♀♀, Jōkō-ji, Aichi Pref., 25. v. 1968, B. TANAKA leg. (KMNHIR000, 051, 108-109).

Distribution: Japan.

1-5. Phylogenetic relationships in the genus *Protodeltote*.

This genus consists of four species, i. e., *pygarga*, *wiscotti*, *distinguenda* and *inexpectata*. It is characterized by an autapomorphy that a long and broad process is present on the middle portion of dorsal margin of sacculus in the male genitalia. However, the phylogenetic relationships among the four species are now uncertain. Synapomorphies for any species have not been found in the course of this study. These species are easily

distinguished from each other by the character-states as mentioned in the key and each description. But, these character-states are not inferred to synapomorphies. The same character-states, for example, the shape of posterior margin of copulatory cavity and colouration of hind wing are also found in the other species of Japanese Acontiinae. It is necessary to find new characters for this problem.

2. Genus *Pseudodeltote* UEDA, 1984

Key to the species

Male

1. Tegumen evenly sclerotized and separated into anterior portion and posterior portion by a deep groove; cornuti absent..... 2
- Tegumen separated into well sclerotized anterior portion and weakly sclerotized posterior portion; cornuti present *formosana*
2. Uncus falciform, evenly curved ventrally, and with acute tip; process from sacculus not produced dorsally beyond costa..... 3
- Uncus slightly curved dorsally at subapical portion; process from sacculus produced dorsally beyond costa *brunnea*
3. Valvae asymmetrical; right valva with large ampulla; ventral sclerotized portion of suprazonal sheath forming digitiform process on its apical portion *subcoenia*
- Valvae symmetrical and without ampulla; ventral sclerotized portion of suprazonal sheath flat and slightly concaved on its apical portion *coenia*

Female

1. Seventh abdominal segment with concavities anterolaterad and its sternum shorter, much shorter than its tergum..... 2
- Seventh abdominal segment without a pair of anterolateral concavities and its sternum longer, only lightly shorter than its tergum *formosana*
2. Ductus bursae slightly bulged near the copulatory cavity 3
- Ductus bursae greatly bulged near the copulatory cavity *subcoenia*
3. Seventh abdominal sternum with posterior margin slightly concaved at the middle, and without lateral spinules..... *brunnea*
- Seventh abdominal sternum with posterior margin greatly concaved at the middle, and with dense lateral spinules..... *coenia*

2-1. *Pseudodeltote brunnea* (LEECH, 1889)

(Figs., 11, 12, 29-A)

Erastria brunnea LEECH, 1889, *Proc. Zool. Soc. Lond.* 1889: 527, pl. 54, fig. 2.

Lithacodia brunnea: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 545.

Jaspidia brunnea: INOUE & SUGI, 1958, *Check List of the Lepidoptera of Japan* 5: 545.

Lithacodia brunnea: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 815, 2: 383, pl. 197: 21–23.

Length of fore wing: 9–11 mm.

Frons pale brown mixed with ochreous white; in some specimens dark brown; labial palpus brown mixed with ochreous; antenna brown ringed with ochreous Thorax ochreous white mixed with red-brown; collar brown, slightly tipped with white; pleural area whitish. Fore leg brown; fore tarsus with ochreous rings; mid and hind legs more ochreous. Abdomen pale brown mixed with ochreous white; segmental lines indistinct; ventral portion of abdomen more whitish; dorsal crests on 3rd to 5th segments brown and white at the base.

Fore wing: Ochreous white, irrorated and suffused with red-brown; subbasal line represented by a series of brown spots from costa to vein 1; antemedial line white, slightly defined by red-brown on each side, minutely waved from costa to discal cell, and zig-zag to inner margin; orbicular with large white annulus, which is defined by brown on each side, and filled with red-brown; claviform with indistinct white lunula; a dark brown median shade; reniform with white annulus, opening below; postmedial line white, broad on the anterior portion, angled outwards below costa to vein 6, moderately excurved at vein 5, then curved inwards below vein 4 to vein 2, and waved to inner margin; ochreous costal spots beyond postmedial line indistinct; postmedial area strongly suffused with red-brown; subterminal line white and slightly excurved below veins 7 and 4; subterminal area suffused with ochreous white; a terminal series of dark brown striae becoming obsolete towards tornus; cilia ochreous white, with a fuscous at the middle through them and chequered with fuscous and ochreous white on apical portion.

Hind wing: White irrorated with brown; cilia ochreous white with a fuscous line at the middle through them.

Underside of fore wing: White irrorated with brown; costal area and sometimes subterminal area tinged with ochreous white.

Underside of hind wing: White and sparsely irrorated with brown on the costal area; sometimes entirely suffused with red-brown; a small discoidal spot brown; postmedial line brown, waved and indistinct,

Male external genitalia: Tegumen small, separated into anterior and posterior portion by a deep groove; in dorsal view, subdorsal portion of tegumen produced posteriorly beyond the base of uncus; fenestrula narrow, well sclerotized; peniculus not developed; vinculum slender, almost as deep as tegumen; a keel-like inner ridge running through at the middle of vinculum; saccus small, projecting dorsally. Uncus slender, densely long-haired beyond the middle, curved ventrally at subbasal portion and slightly curved dorsally near its acute apical portion. Valva rather short, 4 times as long as medially wide; costa broad, slightly descending distally; dorsal margin of the base of harpe slightly swollen; cucullus + harpe short, $\frac{1}{3}$ as long as valva; the dorsal margin of cucullus irregularly expanded; sacculus deep and large, with a large dorsal process, which produces dorsodistally beyond costa. Juxta small, tapering towards distal margin and slightly

concaved basally. Phallus moderately large, curved dorsally near zone and much bent ventrally near its apex; sclerotized portion of suprazonal sheath broad; subzonal sheath with a concaved portion beneath near zone; coecum long, $5/8$ as long as subzonal sheath; cornuti absent.

Female terminalia: Anterolateral portion of 7th abdominal tergum concaved; 7th abdominal sternum short and its lateral portion concaved; posterior margin of 7th abdominal sternum slightly concaved at the middle.

Female genitalia: Eighth abdominal tergum well sclerotized; apophysis anterioris long, 1.5 times as long as width of 8th abdominal tergum; copulatory cavity wide and rather shallow; ventral portion of copulatory cavity well sclerotized. Ductus bursae short, $1/6$ as long as bursa copulatrix and slightly bulged near the copulatory cavity. Ductus seminalis bulged near vagina. Corpus bursae large; cervix bursae short. Papilla analis moderately large and long-haired; apophysis posterioris as long as apophysis anterioris.

Specimens examined: [Japan] 1 ♂, Furano, Hokkaido, 24. vii. 1959, T. KAWARABATA leg. (KMNHIR000, 052); 1 ♂, Shimokita, Aomori Pref., 1. viii. 1957, T. SAIGUSA leg. (KMNHIR000, 053); 1 ♂, Mt. Hikosan, Fukuoka Pref., 2. viii. 1953, H. KUROKO leg. (ELKU); 1 ♂ and 1 ♀, Chōjabara, Ōita Pref., 7. vii. 1977, K. UEDA leg. (KMNHIR000, 054–55); 1 ♀, Shimokita, 20. viii. 1957, T. SAIGUSA leg. (KMNHIR000, 056); 1 ♀, Kuzu Hot Spring, Kyoto Pref., 2. viii. 1919, I. SUGITANI leg. (ELKU); 1 ♀, Kikuchi, Kumamoto Pref., 8. viii. 1975, Y. YOSHIYASU et al. leg. (KMNHIR000, 057).

Distribution: Japan (Hokkaido, Honshu, Shikoku and Kyushu).

2-2. *Pseudodeltote coenia* (SWINHOE, 1901)

(Figs., 36, 37, 86–D)

Metachrostis coenia SWINHOE, 1901, *Ann. Mag. nat. Hist.*, (7) 7: 471.

Lithacodia coenia: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 550, pl. 165, fig. 13.

Length of fore wing: 11–13 mm.

Frons dark brown mixed with white; vertex more whitish; labial palpus dark brown mixed with white and tipped with white on 2nd and 3rd segments; antenna dark brown ringed with white. Thorax white mixed with dark brown; collar dark brown mixed with white and rufous, and tipped with white, pleural area white. Fore leg dark brown mixed with ochreous; fore tarsus banded with ochreous; mid and hind legs almost white. Abdomen white mixed with fuscous; caudal portion with orange tufts in male; dorsal crests on 2nd to 4th segments, white tipped with dark brown.

Fore wing: Ochreous white, suffused with rufous and white; subbasal line represented by dark brown spots on costa and median portion and a slight streak below vein 1; antemedial line ochreous white, defined by rufous on each side below cell and strongly incurved; anterior portion of antemedial line confluent with a broad white streak,

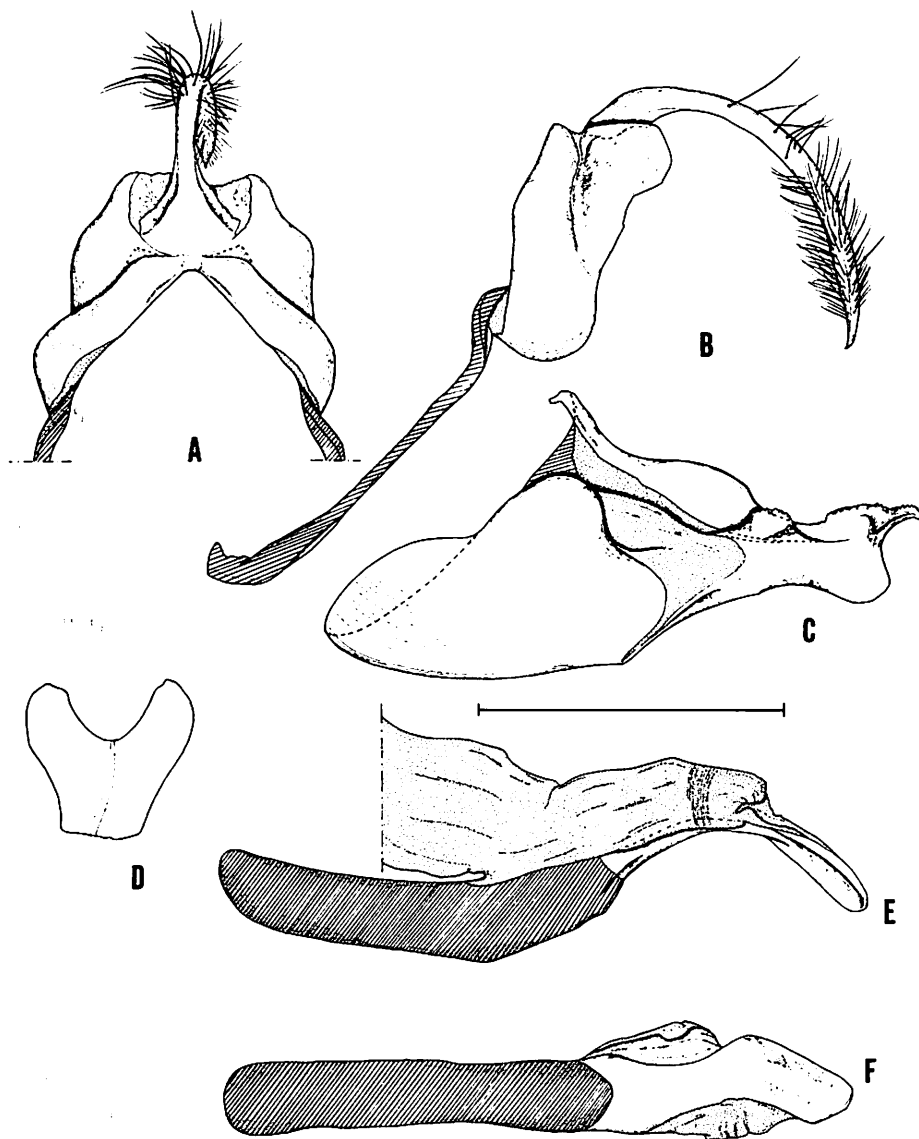


Fig. 36. Male external genitalia of *Pseudodeltote coenia* (SWINHÖE).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. Scales 1 mm.

which is angled obliquely from the costa to cell; orbicular and claviform indistinct; the latter slightly defined by dark brown on outer side; a dark brown median shade suffused with rufous; reniform grey defined by dark brown and constricted at the middle; a broad grey suffusion below costa between oblique antemedial white streak and postmedial line; a

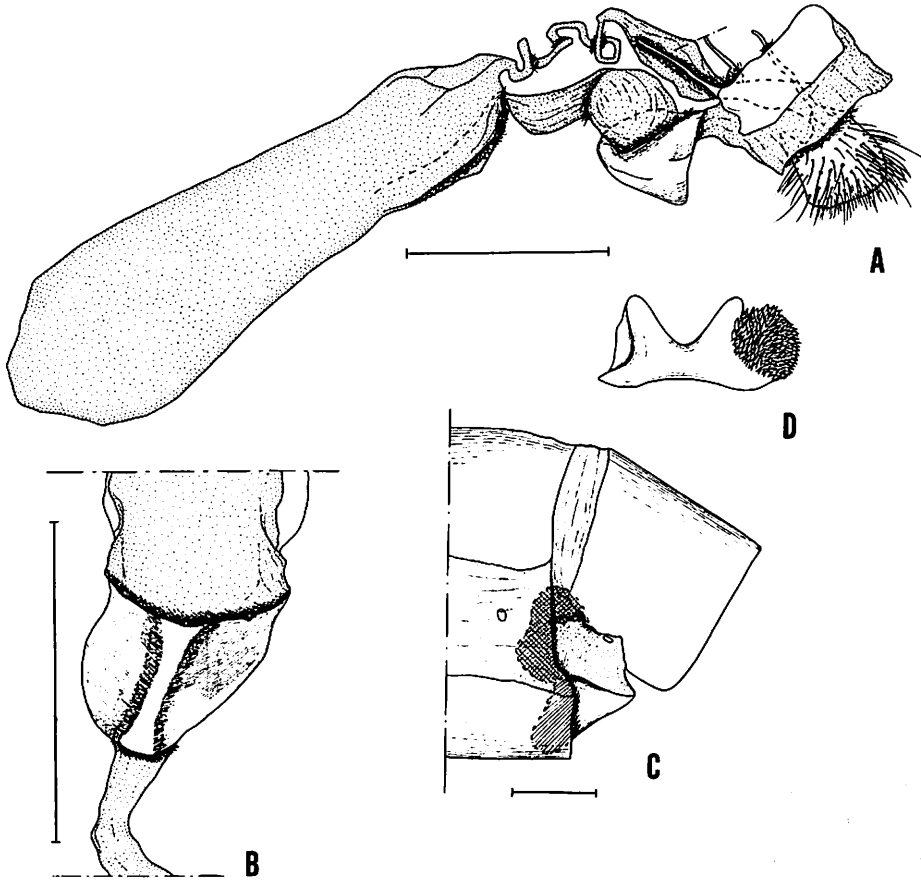


Fig. 37. Female genitalia and terminalia of *Pseudodeltote coenia* (SWINHÖE).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scales 1 mm.

median rufous line from lower angle of the cell and oblique; postmedial line white defined by rufous and dark brown irregularly, oblique from costa to vein 7, waved to vein 4, curved inwards to vein 2 and excurved below vein 1; white costal spots beyond it indistinct; postmedial area dark brown suffused with two wedge-shaped dark brown marks below vein 7; subterminal line white, excurved below vein 7 and vein 4; a terminal series of dark brown striae defined by white on inner side; cilia white; apical portion of cilia chequered with white and fuscous at the middle.

Hind wing: White, sparsely irrorated with brown; a faint terminal series of dark brown striae; cilia white, slightly tipped with fuscous below costa.

Underside of fore wing: White, irrorated with dark brown; costal and terminal areas tinged with ochreous and rufous.

Underside of hind wing: White sparsely irrorated with dark brown and ochreous; dark brown discoidal spot; postmedial line dark brown and not so waved; terminal series of dark brown striae.

Male external genitalia: Tegumen broad and separated into anterior and posterior portions by deep groove; in dorsal view the subdorsal portion of tegumen producing posteriorly beyond the base of uncus; peniculus not much developed; vinculum slender, as deep as tegumen; saccus small, slightly produced dorsally and with an acute tip. Uncus slender, falciform and long-haired beyond the middle. Valva short, 2.5 times as long as medially wide; costa moderately broad and descending distally; the dorsal margin of base of harpe swollen, trapezoidal and with small dentations dorsally; cucullus + harpe short and with a small lateral plate, which projects inwardly; sacculus deep and with large semicircular process on the middle of its dorsal margin. Juxta almost trapezoidal and strongly excavated medially on its distal margin. Phallus large; ventral sclerotized portion of suprazonal sheath flat and slightly concaved on its apical portion; coecum large, 2/3 as long as subzonal sheath and almost straight; cornuti absent.

Female terminalia: Seventh abdominal segment with a pair of anterolateral concavities in the membranous regions between the tergum and sternum; 7th abdominal sternum shorter than its tergum with posterior margin greatly concaved at the middle and bearing many short serrations on each side.

Female genitalia: Eighth abdominal tergum large; apophysis anterioris 2 times as long as 8th abdominal tergum; copulatory cavity broad, deep and well sclerotized. Ductus bursae short, 1/3 as long as corpus bursae and slightly bulged near copulatory cavity. Ductus seminalis slender, slightly longer than ductus bursae and bulged near vagina. Corpus bursae simple and long; cervix bursae short, 1/3 as long as corpus bursae. Signa absent. Palilla analis large, quadrate and sparsely long-haired; apophysis posterioris as long as apophysis anterioris.

Specimens examined: [Taiwan] 1 ♂, Taiheizan (Thaihoku-shu) Kamiyodani, 25. vii. 1932, T. ESAKI leg. (ELKU); 1 ♂, Numanohira, 20. vi. 1932, UMEMO & TAIRA leg. (ELKU); 1 ♂, Tayling, Hualien-Hsien, 1-3. vii. 1973, M. OWADA leg. (KMNHIR000, 058) 1 ♂, Lishan, Taichung-Hsien, 26. vi. 1975, K. UEDA and K. SETOYA leg. (KMNHIR 000, 059); 3 ♀ ♀, Mt. Alishan, Chiayi-Hsien, 19-22. vi. 1973, M. OWADA leg. (KMNHIR 000, 060-62); 1 ♀, Hengchun, Pingtung-Hsien, 18. v. 1973, Y. YOSHIYASU leg. (KMNHIR 000, 063).

Distribution: Taiwan.

2-3. *Pseudodeltote subcoenia* (WILEMAN and SOUTH, 1916) (Figs., 38, 39, 86-E)

Lithacodia subcoenia WILEMAN and SOUTH, 1916, *Entomologist* 49: 181.

Length of fore wing: 9-12 mm.

Frons brown mixed with white; vertex whitish; labial palpus brown, slightly tipped ochreous on 2nd and 3rd segments; antenna brown ringed with white. Thorax brown mixed with white; collar brown, mixed with white and rufous and tipped with white; tegula white beyond the middle; pleural area white. Fore leg brown; fore tarsus brown banded with ochreous white; mid leg more whitish and hind leg almost white. Abdomen brown mixed with rufous and ochreous white; segmental lines ochreous white; ventral portion of abdomen whitish; orange tufts on the caudal portion of male abdomen; dorsal

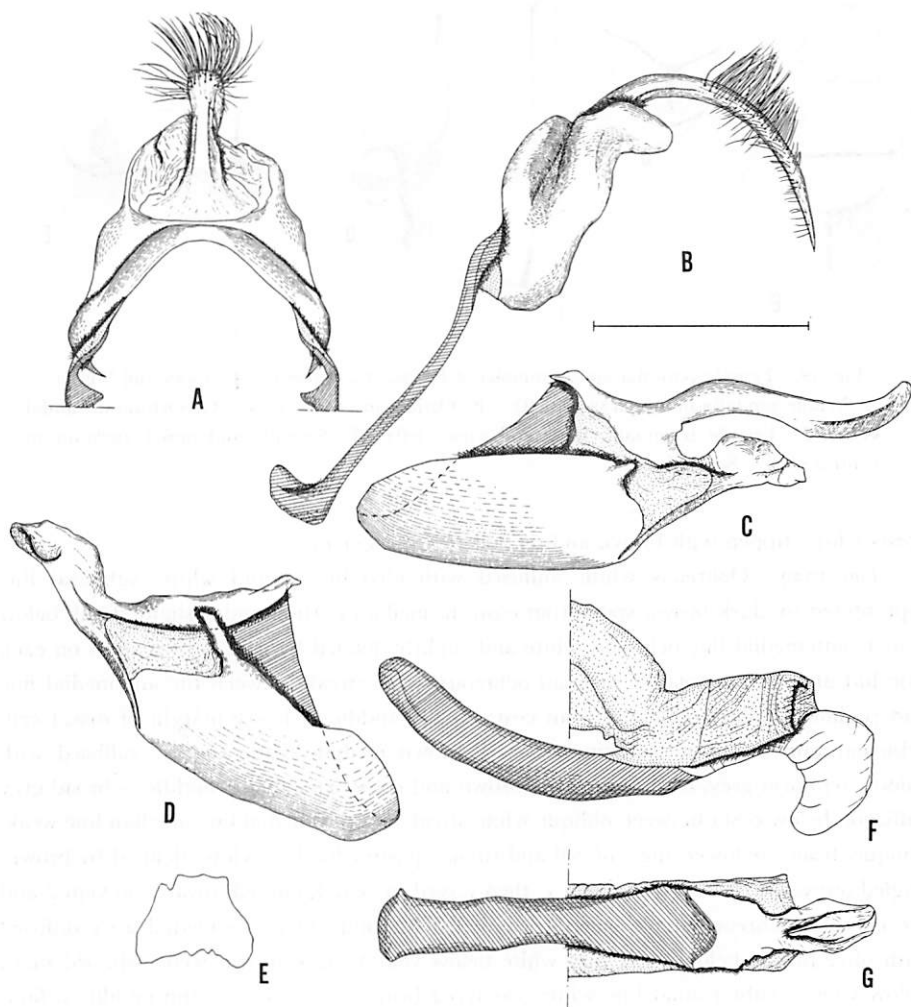


Fig. 38. Male external genitalia of *Pseudodeltote subcoenia* (WILEMAN and SOUTH).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Left valva, inner view. E: Juxta. F: Phallus in lateral view (left). G: Phallus in ventral view. Scale 1 mm.

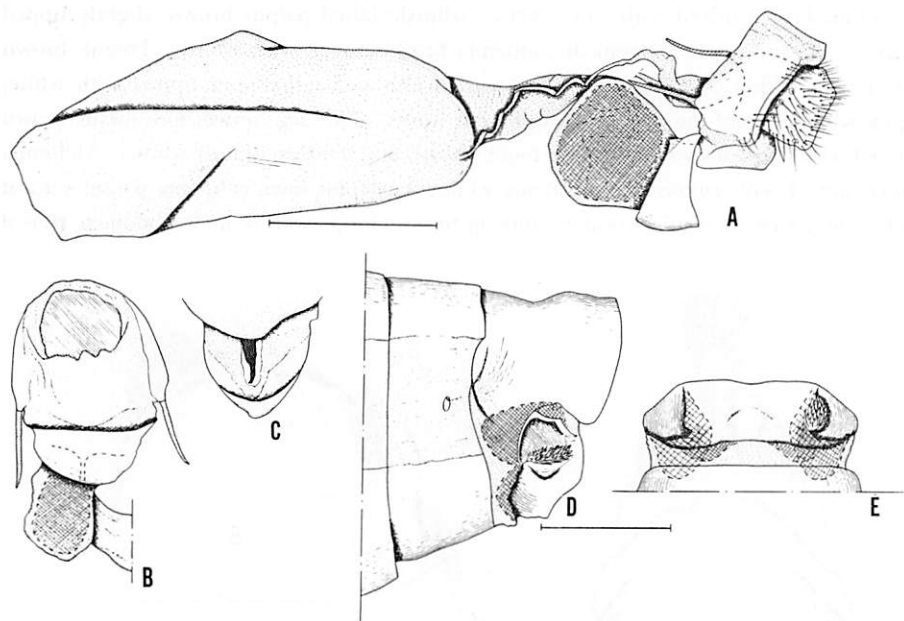


Fig. 39. Female genitalia and terminalia of *Pseudodeltote subcoenia* (WILEMAN and SOUTH). A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Ostium in caudal view. D: Female terminalia in lateral view (left). E: Seventh abdominal sternum in ventral view. Scales 1 mm.

crests white, tipped with brown and on 2nd to 4th segments.

Fore wing: Ochreous white, suffused with olive-brown and white; subbasal line represented by dark brown spots from costa to median portion and a slight streak below vein 1; antemedial line ochreous white and slightly defined by dark brown spots on each side but almost untraceable; a broad ochreous white streak between the antemedial line and reniform angled obliquely from costa to the middle of lower margin of discal cell; orbicular and claviform indistinct; a dark brown median shade slightly suffused with rufous; reniform grey, defined by dark brown and constricted at the middle; a broad grey suffusion below costa between oblique white streak and postmedial line; median line weak, oblique, from the lower angle of cell and rufous; postmedial line white, defined by brown, angled outwards from costa to vein 7, then waved to vein 4, curved inwards to vein 2 and erect; costal ochreous spots beyond postmedial line indistinct; postmedial area suffused with olive-brown below costa and white below vein 4; dark brown wedge-shaped mark below vein 4; subterminal line white, excurved below vein 7 and at the middle; a faint terminal series of dark brown striae, defined by white on inner side; cilia ochreous white.

Hind wing: White irrorated with dark brown; terminal line indistinct; cilia ochreous white.

Underside of fore wing: White, irrorated with dark brown; costal and terminal areas

tinged with ochreous.

Underside of hind wing: White sparsely irrorated with dark brown; discoidal spot and postmedial line dark brown; the latter indistinct in some specimens; cilia white and mixed with fuscous below costa.

Male external genitalia: Tegumen well sclerotized and separated into anterior and posterior portions by deep groove; in dorsal view, the subdorsal portion of tegumen produced posteriorly beyond the base of uncus; in lateral view this produced portion curved ventrally and ended in a rounded tip; peniculus not much developed; vinculum slightly deeper than tegumen and slender; saccus moderate, produced dorsally and ended in a blunt tip. Uncus slender, falcate and long-haired at the middle. Valvae asymmetrical to each other. Right valva almost 3 times as long as medially wide; costa broad and gradually descending distally, and broad ampulla produced from the middle of dorsal margin of valva, extending posteriorly far beyond the tip of cucullus + harpe, gently curved dorsally and ended in a rounded tip; cucullus + harpe short, weakly expanded dorsally; sacculus broad, with a small process on its dorsodistal angle. Left valva almost 3 times as long as medially wide; costa broad, much weakly descending distally; ampulla absent; cucullus + harpe short, strongly expanded dorsally and with a small flat, which projects inwards on its apical portion; sacculus broad, bearing a slender and long process on the middle of its dorsal margin. Juxta almost trapezoidal; ventral margin of juxta concaved. Phallus large; ventral sclerotized portion of suprazonal sheath well sclerotized and broad, gradually curved dorsally, then strongly curved ventrally at the middle and forming a digitiform process on its apical portion; coecum long, 3/4 as long as subzonal sheath, curved dorsally towards tip, which bears a pair of small lateral processes; cornuti absent.

Female terminalia: Seventh abdominal sternum shorter than its tergum; anterolateral portion of 7th abdominal sternum produced anteriorly and forming a large pocket-like structure; many serrations present near its opening; posterior margin of 7th abdominal sternum almost straight.

Female genitalia: Eighth abdominal tergum weakly sclerotized; apophysis anterioris subequal in length to 8th abdominal tergum; copulatory cavity rather small, shallow and well sclerotized. Ductus bursae 1/2 as long as corpus bursae and greatly bulged near copulatory cavity. Ductus seminalis slender, subequal to ductus bursae and slightly bulged near vagina. Corpus bursae large; cervix bursae 1/2 as long as corpus bursae. Signa absent. Papilla analis almost quadrate but its dorsodistal portion rounded and sparsely long-haired; apophysis posterioris as long as apophysis anterioris.

Specimens examined: [Taiwan] 1 ♂, Hori, 8. ix. 1926, A. KAWADA leg. (collection of National Institute of Agricultural Science, Tsukuba); 1 ♂, data unknown with a number 3696, (same collection); 1 ♀, Hotso, Nantou-Hsien, 26-29. vi. 1973, M. OWADA leg. (KMNHIR000, 064).

Distribution: Taiwan.

Remarks: This species is similar to *P. coenia* (SWINHÖE) but the former is easily

distinguished from the latter by the following character-states: 1) antemedial line indistinct, 2) antemedial oblique streak indistinct, 3) hind wing dark brown, 4) valvae asymmetrical and 5) phallus with a digitiform apical projection on its suprazonal sheath.

2-4. *Pseudodeltote formosana* (HAMPSON, 1910)
(Figs., 40, 41, 86-F)

Lithacodia formosana HAMPSON, 1910, Cat. Lepid. Phalaenae Br. Mus. 10: 526, pl. 164, fig. 21.

Length of fore wing: 12-14 mm.

Frons white sparsely mixed with dark brown; vertex slightly dark; labial palpus dark brown, slightly tipped with ochreous white on 2nd and 3rd segments; antenna dark brown

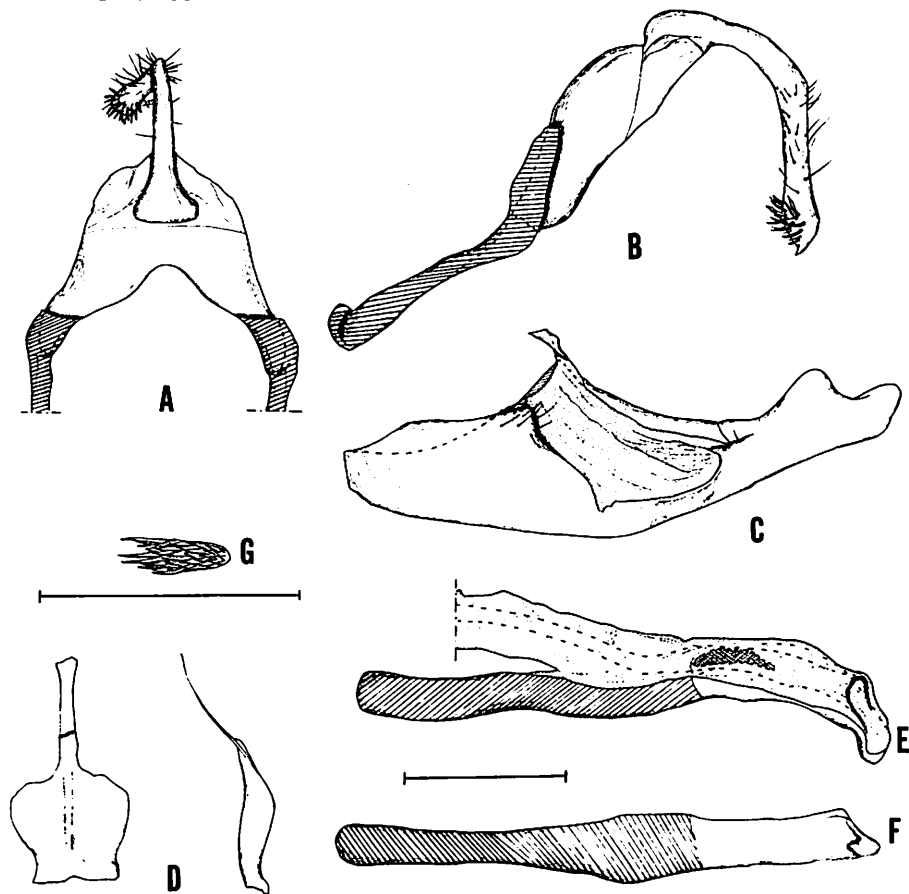


Fig. 40. Male external genitalia of *Pseudodeltote formosana* (HAMPSON).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta in ventral and lateral views. E: Phallus in lateral view (left). F: Phallus in ventral view. G: Cornuti. Scales 0.5 mm.

ringed with white. Thorax white; collar sparsely mixed with dark brown and olive-green; tegula tipped with dark brown; pleural area white. Fore leg dark brown mixed with white; fore tarsus distinctly ringed with ochreous white; mid and hind legs more whitish. Abdomen white mixed with dark brown; ventral portion of abdomen more whitish; dorsal crests on 3rd to 5th segments dark brown and whitish at the base.

Fore wing: Dark brown suffused with olive-green; subbasal line represented by a dark brown patch at the base of wing; antemedial line olive-green, defined by dark brown on each side, minutely waved from costa to vein 1 and confluent with a large olive-green annulus, which is filled with dark brown; claviform absent; a dark brown median shade; reniform with a olive-green, 8 figure-shaped mark open below; postmedial line olive-green, defined by dark brown on inner side, oblique to vein 7, then sinuous to vein 5, curved inwards to vein 2 and waved to inner margin; postmedial area dark brown except olive-green suffusion below vein 3; subterminal line olive-green, rather broad and excurved below vein 7 and at the middle; a terminal series of dark brown striae indistinct; cilia fuscous with white line at the base, chequered with fuscous and white on apical half.

Hind wing: White, sparsely irrorated with dark brown; an indistinct dark brown

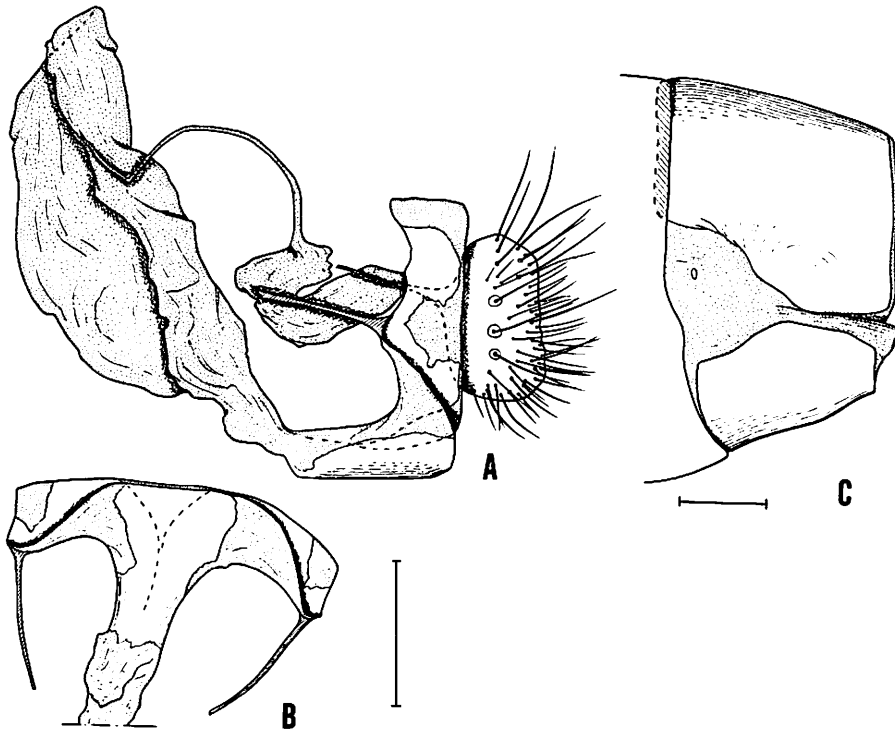


Fig. 41. Female genitalia and terminalia of *Pseudodeltote formosana* (HAMPSON).
A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). Scales 0.5 mm.

terminal line; cilia white with an indistinct fuscous line at the middle.

Underside of fore wing: White irrorated with dark brown; costal area tinged with ochreous and rufous; a faint terminal line dark brown.

Underside of hind wing: White sparsely irrorated with dark brown; a small discoidal spot and minutely waved postmedial line dark brown; postmedial area suffused with dark brown and slightly tinged with rufous; a faint terminal line dark brown.

Male external genitalia: Tegumen moderately large, separated into strongly sclerotized anterior portion and weakly sclerotized posterior portion; fenestrula very narrow and indistinct; peniculus not developed; vinculum rather broad, as deep as tegumen; saccus small. Uncus thick, curved ventrally, almost straight beyond the middle, pointed at apex, sparsely haired, and bearing thick and short hairs on apical portion. Valva moderately large, 4 times as long as medially wide; costa narrow and gradually descending distally; the dorsal margin of base of harpe forming a small and weak ridge; cucullus + harpe short, 1/3 as long as valva, projecting dorsally at the middle and with a truncated distal margin; the dorsal margin of cucullus + harpe projecting dorsally at the middle; sacculus broad and weakly swollen at the middle of its dorsal margin. Juxta almost quadrate and weakly keeled ventromedially; a narrow projection from its posterior margin and as long as juxta. Phallus slender; in lateral view, sclerotized portion of suprazonal sheath moderately broad, abruptly curved ventrally at subapical portion; coecum 1/2 as long as subzonal sheath; cornuti small, represented by a group of spines of various lengths.

Female terminalia: Seventh abdominal tergum more or less expanding posterolaterally; 7th abdominal sternum only lightly shorter than its tergum.

Female genitalia: Eighth abdominal tergum weakly sclerotized laterally with a large membranous incision on the posterolateral portion dorsally; apophysis anterioris long, 2 times as long as 8th abdominal tergum; copulatory cavity deep; its ventral sclerotized portion slightly dilating posteriorly. Ductus bursae short, 1/3 as long as corpus bursae. Ductus seminalis 3 times as long as ductus bursae. Corpus bursae short and small; cervix bursae short. Papilla analis large, oblong and densely long-haired; its dorsal and ventral margins rounded; apophysis posterioris slender and as long as apophysis anterioris.

Specimens examined: [Taiwan] 1 ♂, Taiheizan, (Taihokushū), 21. viii. 1932, K. SATŌ leg. (ELKU); 1 ♂, Matsumine, (Taichūshū), 25. vii. 1941, I. FUKUSHIMA leg. (ELKU); 4 ♂♂ 1 ♀, Mt. Alishan, Chiai-Hsien, 16. vi. 1975, K. UEDA and K. SETOYA leg. (KMNHIR000, 065-69); 1 ♀, Musha, 16. viii. 1921, T. ESAKI leg. (ELKU); 1 ♀, Taiheizan (Taihokushū), 21. viii. 1932, K. SATŌ leg. (ELKU).

Distribution: Taiwan.

2-5. Phylogenetic relationships in the genus *Pseudodeltote* (Fig. 42).

This genus consists of four species, i.e., *brunnea*, *coenia*, *subcoenia* and *formosana*. It is

characterized by the following autapomorphy; dorsal margin of cucullus irregularly rugged. Three monophyletic subgroups, i.e., the *brunnea*-, the *coenia*- and the *formosana*-subgroups, are recognized. The autapomorphies and interspecific relationships of each subgroup and the phylogenetic relationships among subgroups are discussed as follows.

(1) the *brunnea*-subgroup: This subgroup includes only *brunnea*. It is characterized by an autapomorphy; the dorsal margin of uncus curved dorsally (Fig. 42-1).

(2) the *coenia*-subgroup: This subgroup includes *coenia* and *subcoenia*. It is characterized by an autapomorphy; many small serrations are present in the lateral portions of female 7th abdominal sternum (Fig. 42-2). *P. coenia* is specialized in bearing well developed harpe (Fig. 42-3). On the other hand, *P. subcoenia* is specialized in bearing asymmetrical valvae and the apical portion of suprazonal sheath developed into digitiform plate (Fig. 42-4).

(3) the *formosana*-subgroup: This subgroup includes only *formosana*. It is characterized by the following autapomorphies; cornuti present, apical portion of uncus with special short hairs, and M. 3 is absent in the musculature of male external genitalia.

(4) the phylogenetic relationships of the 3 subgroups: It is inferred that the *brunnea*- and the *coenia*-subgroups form a monophyletic group characterized by the following synapomorphies; female 7th abdominal sternum much shorter than its tergum and the symerolateral portion of 7th abdominal segment with a pair of concavities. Theses

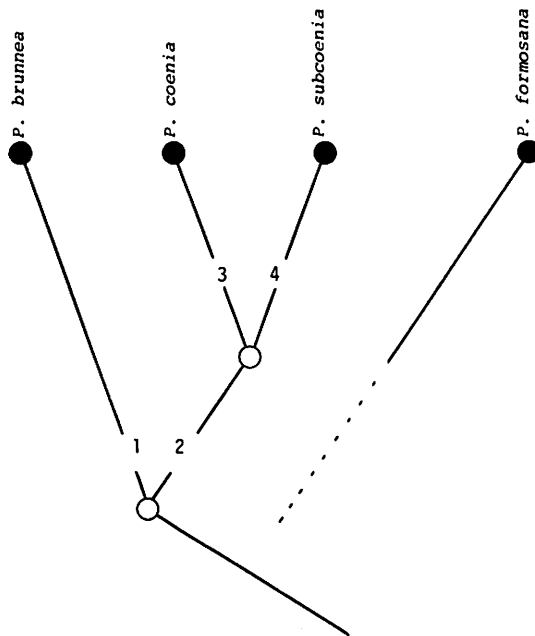


Fig. 42. Inferred phylogenetic relationships in the genus *Pseudodeltote*.

characters are retained in the plesiomorphic states in the *formosana*-subgroup. However, the *formosana*-subgroup is rather specialized in having the above mentioned character-states. Moreover, lateral groove of tegumen, which is inferred as an autapomorphy for *Pseudodeltote* and *Micardia*, is indistinct in *formosana*. Therefore, I tentatively include this species into the genus *Pseudodeltote*.

3. Genus *Micardia* BUTLER, 1878

Key to the species

1. A large and broad silver streak present on the discal cell of fore wing.....*argentata*
- Silver streak absent on the discal cell of fore wing *pulchra*

3-1. *Micardia argentata* BUTLER, 1878

(Fig., 13, 14, 29-D)

Micardia argentata BUTLER, 1878, *Ann. Mag. nat. Hist.* (5) 1: 81.

Eustrotia argentata: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 574.

Micardia argentata: WARREN, 1912, in Seitz Gross-Schmett. *Erde* 3: 280, t. 52e.

Micardia argentata: INOUE & SUGI, 1958, *Check List Lepid. Japan* 5: 546.

Micardia argentata: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 813, 2: 383, pl. 197: 2-3.

Length of fore wing: 13-15 mm.

Frons ochreous mixed with dark brown; vertex rufous brown; labial palpus dark brown mixed with ochreous and rufous; antenna dark brown distinctly ringed with ochreous white. Thorax ochreous white mixed with dark brown and rufous; collar ochreous white mixed with rufous brown; tegula rufous brown on posterior half; posterior crest of thorax moderate and ochreous white; pleural area white; legs ochreous white mixed with brown; tarsi dark brown ringed with ochreous white. Abdomen ochreous white mixed with dark brown; dorsal crest on 1st segment, indistinct and rufous brown.

Fore wing: Ochreous white tinged with rufous; the middle portion of costa with a large dark brown patch, which is suffused with purplish pink; the costal area beyond it ochreous white and tinged with brown near apex; subbasal and antemedial lines absent; a large and broad silver streak present on the discal cell; claviform absent; reniform stigma with indistinct white annulus, which is filled with purplish pink and constricted at the middle; postmedial line white, indistinct below costa, tinged with purplish pink and brown below vein 7 and incurved to inner margin; subterminal line white, almost parallel with termen; a terminal series of dark brown striae indistinct; cilia ochreous white with indistinct dark brown line at middle; some dark brown scales at the middle of cilia.

Hind wing: Ochreous white, irrorated with brown; terminal line indistinct; cilia white.

Underside of fore wing: Ochreous white suffused with brown; costal and subterminal areas tinged with rufous; terminal line represented by a series of dark brown striae; cilia ochreous white with faint brown scales at middle.

Underside of hind wing: Ochreous white sparsely irrorated with brown; small discoidal spot brown; postmedial line untraceable; terminal line a series of dark brown striae; cilia ochreous white.

Male external genitalia: Tegumen separated into anterior and posterior portions by a deep lateral groove; in dorsal view, tegumen tapering posteriorly and its subdorsal portion produced posteriorly beyond the base of uncus; fenestrula represented by well sclerotized narrow groove; peniculus well developed; vinculum slender and almost as deep as tegumen; saccus small, projecting dorsally. Uncus broad, strongly curved ventrally, slightly dilating towards bluntly pointed tip with an acute spine and densely long-haired beyond the middle. Valva long and 5 times as long as medially wide; costa broad and gently descending distally; dorsal margin of harpe slightly swollen at the base; cucullus + harpe narrow and strongly curved dorsally and its inner wall broadly concaved; sacculus moderately broad and bearing at the posterodorsal portion a small process which does not extend the costa. Juxta almost oblong and keeled at the ventromedial portion. Phallus moderately long; ventral sclerotized portion of suprazonal sheath broad, its apical portion strongly curved ventrally; coecum long, almost 1/2 of subzonal sheath; cornuti represented by some series of minute spines.

Female terminalia: Middle portion of 7th abdominal tergum broadly membranous dorsally; 7th abdominal sternum gently curved dorsally in lateral view.

Female genitalia: Eighth abdominal tergum broad; apophysis anterioris shorter than 1/2 length of 8th abdominal tergum; copulatory cavity broad and deep; its ventral sclerotized portion almost 1/2 as long as the copulatory cavity. Ductus seminalis slender and slightly bulged beyond the middle. Corpus bursae large; cervix bursae short and 1/5 as long as corpus bursae. Signa absent. Papilla analis densely long-haired; apophysis posterioris 2 times as long as apophysis anterioris.

Specimens examined: [Japan] 3 ♂♂, Chōjabaru, Mt. Kuju, Ōita Pref., 6. vi. 1978, K. SETOYA leg. (KMNHIR000, 070–72); 1 ♂, Kashii, Fukuoka Pref., 17. v. 1972, M. ŌBA leg. (KMNHIR000, 073); 1 ♀, Minami Park, Fukuoka Pref., 1. vi. 1974, K. UEDA leg. (KMNHIR000, 074); 1 ♀, Chōjabaru, Mt. Kuju, Ōita Pref., 7. vi. 1978, K. SETOYA leg. (KMNHIR000, 075).

Distribution: China, Korea and Japan.

3–2. *Micardia pulchra* BUTLER, 1878

(Figs., 43, 44, 86–G)

Micardia pulchra BUTLER, 1878, *Ann. Mag. nat. Hist.* (5) 1: 81.

Eustrotia pulchra: HAMPSON; 1910, *Cat. Lepid. Phalaenae* Br. Mus. 10: 575.

Micardia pulchra: WARREN, 1912, in Seitz Gross-Schmett. *Erde* 3: 280, t. 52c.

Micardia pulchra: INOUE & SUGI, 1958, Check List of Lepid. Japan 5: 546.

Micardia pulchra: SUGI, 1982, In INOUE, H. et al., Moths of Japan 1: 813, 2: 383, pl. 197: 1.

Length of fore wing: 13–15 mm.

Frons ochreous mixed with dark brown and rufous brown; vertex rufous brown; labial palpus dark brown mixed with ochreous and rufous brown; antenna dark brown, distinctly ringed with ochreous white. Thorax ochreous white mixed with dark brown; collar ochreous white with rufous patch at the middle; posterior portion of tegula rufous brown; anterior and posterior crests of thorax very large and rufous brown; pleural area white; legs dark brown mixed with ochreous white; tarsi dark brown ringed with ochreous white. Abdomen ochreous white mixed with dark brown; caudal portion of abdomen whitish; dorsal crests on 1st and 2nd segments, dark brown mixed with rufous brown and slightly tipped with white.

Fore wing: Rufous brown mixed with ochreous; the middle portion of costa with a large dark brown patch, which is suffused with purplish pink; the costal area beyond its yellow tinged with rufous brown to apex; subbasal and antemedial lines absent; orbicular being large, with oblique white annulus filled with purplish pink and as long as reniform;

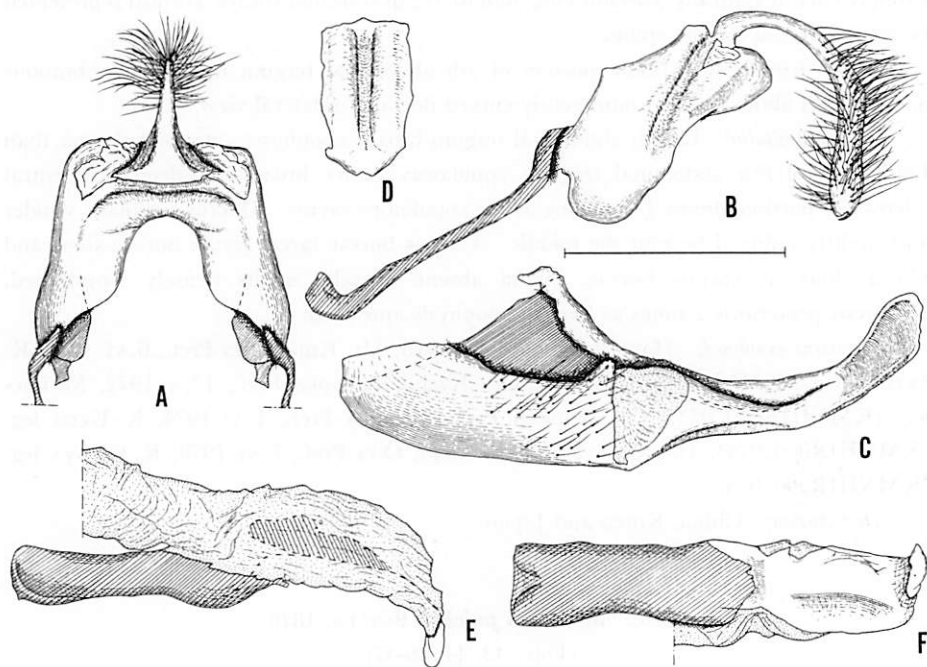


Fig. 43. Male external genitalia of *Micardia pulchra* BUTLER.

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. Scale 1 mm.

claviform absent; reniform stigma with indistinct white annulus filled with purplish pink and constricted at the middle; postmedial line ochreous white below costa, acutely angled outwards to near subterminal line, then defined by purplish pink on outer side and incurved to inner margin; an ochreous white line running almost parallel with postmedial line below vein 7; the anterior portion of this line confluent with subterminal line and the posterior portion with the postmedial line respectively; subterminal line broad, ochreous white and parallel with termen; a terminal series of dark brown striae; cilia ochreous white with a dark brown line at middle through them; some dark brown scales at apex and at the middle of cilia.

Hind wing: Ochreous white, irrorated with brown; terminal line indistinct; cilia

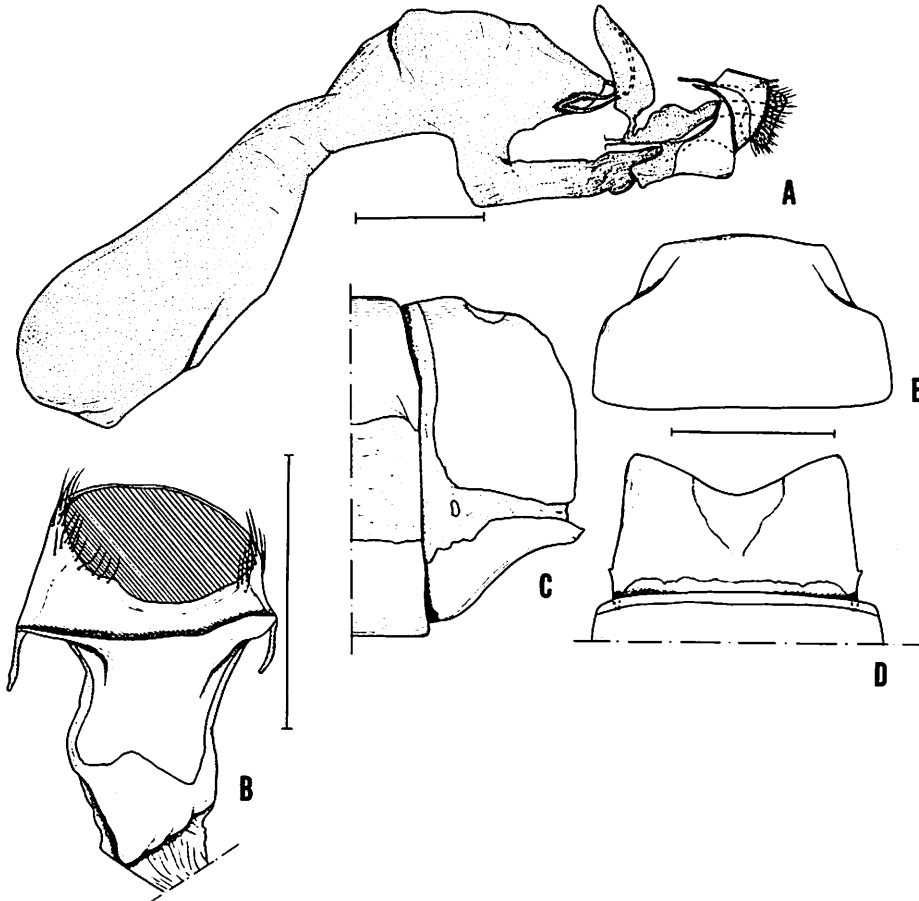


Fig. 44. Female genitalia and terminalia of *Micardia pulchra* BUTLER.

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal tergum in dorsal view. E: Seventh abdominal sternum in ventral view. Scales 1 mm.

ochreous white.

Underside of fore wing: Ochreous white suffused with brown; costal area and subterminal area tinged with reddish yellow; terminal line faint, represented by a series of dark brown striae; cilia ochreous white with dark brown scales at middle and at tips.

Underside of hind wing: Same as the former species *argentata*.

Male external genitalia: Tegumen separated into anterior and posterior portions by a deep groove; in dorsal view, tegumen rather truncate and its subdorsal portion of tegumen produced posteriorly beyond the base of uncus; fenestrula represented by well sclerotized narrow groove; peniculus developed and rounded; vinculum slender and almost as deep as tegumen; saccus small and projecting dorsally. Uncus broad, strongly curved ventrally, dilating towards blunt tip bearing an acute spine, and densely long-haired beyond the middle. Valva long and 5 times as long as medially wide; costa broad, strongly descending distally; dorsal margin of harpe slightly swollen at the base; cucullus + harpe narrow and curved dorsally and its inner wall broadly concaved on its apical 1/2; sacculus broad and bearing a small dorsodistal process, the apex of which reaches to costa. Juxta large, almost oblong and keeled at the ventromedial portion. Phallus moderate; ventral sclerotized portion of suprazonal sheath broad, strongly curved ventrally; cocum longer than 1/2 of subzonal sheath; a triangular depression present at the anterior end of coecum; cornuti represented by some series of minute spines.

Female terminalia: Seventh abdominal tergum with a large and triangular posterior membranous region at the middle; 7th abdominal sternum strongly curved dorsally in lateral view.

Female genitalia: Eighth abdominal tergum rather narrow; apophysis anterioris very short and almost 1/4 length of 8th abdominal tergum; copulatory cavity broad and deep; its ventral sclerotized portion longer than 1/2 of the copulatory cavity. Ductus seminalis slender and bulged beyond the middle. Corpus bursae large; cervix bursae short and 1/5 as long as corpus bursae. Signa absent. Papilla analis densely long-haired; apophysis posterioris 4 times as long as apophysis anterioris.

Specimens examined: [Japan] 1 ♂, Harayama, Gifu Pref., 10. vi. 1975, H. ENDO leg. (KMNHIR000, 076); 1 ♂, Hinoki-pass, Gifu Pref., 9–11. vi. 1967, Y. ARITA leg. (KMNHIR000, 077); 1 ♂, Chōjabaru, Ōita Pref., 6. vi. 1978, K. SETOYA leg. (KMNHIR000, 078); 2 ♀ ♀, Mt. Kurodake, Ōita Pref., 10. vi. 1972, K. UEDA leg. (KMNHIR000, 079–80); 1 ♀, Kureko, Kumamoto Pref., 3. vi. 1976, K. ŌHARA leg. (KMNHIR000, 081).

Distribution: Korea, Ceylon (?) and Japan.

4. Genus *Koyaga* UEDA, 1984

Key to the species

Male

1. Apical portion of valva with special hairs 2
- Apical portion of valva without special hairs 3

2. Basal portion of harpe with a process on its dorsal margin; dorsal margin of cucullus + harpe evenly curved dorsally; coecum with a keel-like muscle attachment *numisma*
- Basal portion of harpe without processes; dorsal margin of cucullus + harpe swollen; coecum without muscle attachment *falsa*
3. Dorsal margin of harpe with two processes 4
- Dorsal margin of harpe with one process *virescens*
4. Spines of cornuti very long *senex*
- Spines of cornuti minute *viriditincta*

Female

1. Ductus bursae almost straight throughout its length 2
- Ductus bursae more or less twisted 3
2. Lamella postvaginalis present; ventral portion of copulatory cavity uniformly sclerotized *falsa*
- Lamella postvaginalis absent; ventral portion of copulatory cavity sclerotized along the posterior margin *virescens*
3. Ductus bursae twisted near copulatory cavity; posterior margin of 7th abdominal sternum evenly curved *numisma*
- Ductus bursae twisted near corpus bursae; posterior margin of 7th abdominal sternum rounded *senex*

4-1. *Koyaga falsa* (BUTLER, 1885)
(Figs., 15, 16, 28-F, G)

Miana falsa BUTLER, 1885, *Cist. Ent.* 3: 132.

Lithacodia falsa: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 541.

Jaspidia falsa: INOUE & SUGI, 1958, *Check List of the Lepid. Japan* 5: 544.

Lithacodia falsa: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 818, 2: 383, pl. 197: 53-56.

Length of fore wing: Male; 11-13 mm, female; 13-15 mm.

Head dark brown mixed with white; apical portion of frons and vertex sometimes more whitish; labial palpus dark brown mixed with white; antenna fuscous, ringed with white. Thorax dark brown mixed with white and fuscous; tegula with a white patch on the middle; pleural area white; legs dark brown mixed with white; tarsi ringed with ochreous. Abdomen fuscous mixed with white; segmental lines indistinct and white; ventral portion of abdomen more whitish; dorsal crests on 3rd to 5th segments and dark brown.

Fore wing: Dark brown irrorated with white and rufous; subbasal line dark brown, indistinct from costa to vein 1; antemedial line dark brown defined by white on inside, excurred from costa to median fold, then almost straight to inner margin; orbicular stigma indistinct, with white incomplete annulus; claviform more indistinct, with white marking which is sometimes absent; reniform with white, figure of 8-shaped annulus, basal portion

of which incomplete; postmedial line white, sharply defined by dark brown on inner side, oblique from costa to vein 7, running to vein 5 almost parallel to termen, then angled inwards to vein 3, and moderately curved inwards between veins 1 and 2; some ochreous spots beyond its on costa; a large patch of white suffusion on postmedial and terminal areas below vein 4*¹); subterminal line white sparsely mixed with ochreous, waved and excurved at vein 7 and at middle; a terminal series of dark brown striae; basal half of cilia fuscous with two slender white lines through them; apical half of cilia chequered with white and fuscous.

Hind wing: White irrorated with brown; a grey terminal series of striae; basal half of cilia fuscous with a white line through them; apical half of cilia chequered with white and fuscous.

Underside of fore wing: White mixed with brown, costal area and subterminal area tinged with ochreous.

Underside of hind wing: White with brown scales sparsely mixed; discoidal spot and minutely waved postmedial line brown; terminal line brown.

Male external genitalia: Tegumen moderately large, anteriorly excavated on the dorsomedial portion; fenestrula very narrow and indistinct; peniculus not much developed; vinculum broad, $\frac{2}{3}$ as deep as tegumen and with an inner ridge running through it; saccus large, almost triangular in lateral view. Uncus broad, falcate, as long as the whole ring and clothed with minute long hairs beyond the middle and characteristic spine-like hairs apically. Valva very large, long and 6 times as long as medially wide; costa broad, strongly descending distally; cucullus + harpe with two distinct swellings on dorsal margin; a shallow groove on the base of cucullus + harpe; apical half of cucullus + harpe densely covered with broad scales bearing large sockets; sacculus broad. Juxta almost oblong with a projected dorsal margin. Phallus very long, $\frac{4}{5}$ as long as valva, slightly curved dorsally beyond zone, then curved ventrally near apical portion and ended in a blunt tip; the ventral sclerotized portion of suprazonal sheath moderately broad; a small triangular membranous incision on subzonal sheath near zone; coecum very long, about basal $\frac{2}{3}$ of subzonal sheath; cornutus represented by a plate bearing many short spines.

Female terminalia: Seventh abdominal segment tapering posteriorly; lateral membranous region between tergum and sternum narrow.

Female genitalia: Eighth abdominal tergum weakly sclerotized; apophysis anterioris slender, 2 times as long as 8th abdominal tergum; copulatory cavity rather narrow and its ventral wall well sclerotized; lamella postvaginalis represented by a median plate, which is dilating towards distal margin. Ductus bursae long, $\frac{1}{2}$ as long as corpus bursae, with many irregular folds. Ductus seminalis as long as ductus bursae, a little bulged near the vagina. Corpus bursae long and slender. Signa absent. Papilla analis almost oblong

*¹ In some specimens, this white patch tends to be absent (Fig. 28-F). In these cases, this area is covered with olive-brown scales, or postmedial line of this area tends to become broader.

with a rounded dorsal margin and densely long-haired; apophysis posterioris 2/3 as long as apophysis anterioris.

Specimens examined: [Japan] 1 ♂, Mt. Ishizuchi, Ehime Pref., 26. vii. 1956, Y. MIYATAKE leg. (KMNHIR000, 082); 1 ♂, Mt. Hikosan, Fukuoka Pref., 27. vii. 1974. K. UEDA leg. (KMNHIR000, 083); 1 ♀, Shimokita, Aomori Pref., 17. viii. 1957, T. SAIGUSA leg. (KMNHIR000, 084); 1 ♀, Kōyanoike (2,100 m alt.), Mt. Hiuchi, Niigata Pref., 5–6. viii. 1972, A. SEINO leg. (KMNHIR000, 085).

Distribution: China, Korea and Japan.

4-2. *Koyaga numisma* (STAUDINGER, 1888)
(Figs., 45, 46, 86-H)

Erastria numisma STAUDINGER, 1888, *Stett. Ent. Zeit.* 49: 265.

Lithacodia numisma: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 546.

Jaspidia numisma: INOUE & SUGI, 1958, *Check List of the Lepid. Japan* 5: 545.

Lithacodia numisma: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 815, 2: 383, pl. 197: 24–25.

Length of fore wing: 8–11 mm.

Frons white mixed with dark brown; a dark brown bar between scapes; vertex almost white; labial palpus dark brown, narrowly whitish at tips of 2nd and 3rd segments; antenna dark brown ringed with white. Thorax dark brown; collar dark brown tipped with white; a distinct transverse white band between the middle portions of tegulae; scutellum white mixed with olive-brown; pleural area whitish; legs dark brown mixed with ochreous; tarsi ringed with ochreous. Abdomen dark brown with white segmental lines; dorsal portion of 5th to 7th segments suffused with olive-brown; caudal portion of abdomen orange; ventral portion of abdomen fuscous mixed with white, dorsal crests on 3rd to 5th segments white tipped with black.

Fore wing: Dark brown suffused with olive-brown especially on medial and postmedial areas; subbasal line white running obliquely from costa to inner margin; antemedial line white defined by dark brown on outer side, curved inwards from costa to discal cell, then excurved outwards and again curved inwards to inner margin; orbicular and claviform with white annuli, which are fused each other and form oblique figure 8-shaped mark; costal area suffused with white above orbicular; median shade dark brown with a large olive-brown patch on the middle; reniform stigma with white annulus, indistinct at the lower extremity and constricted at the middle of outer margin; postmedial line dark brown, untraceable between costa and vein 8, minutely waved from veins 8 to 4, then incurved; 3 white costal spots beyond it; a dark brown apical patch; subterminal line white, angled outwards at vein 7 and minutely waved; a faint dark brown streak beyond it to terminal line below vein 4; terminal line dark brown, almost suffused with olive-brown below vein 6; cilia white, on basal half with dark patches on apex, middle and tornus, on apical half chequered with white and dark brown.

Hind wing: White irrorated with golden brown; a faint brown terminal sereis; cilia

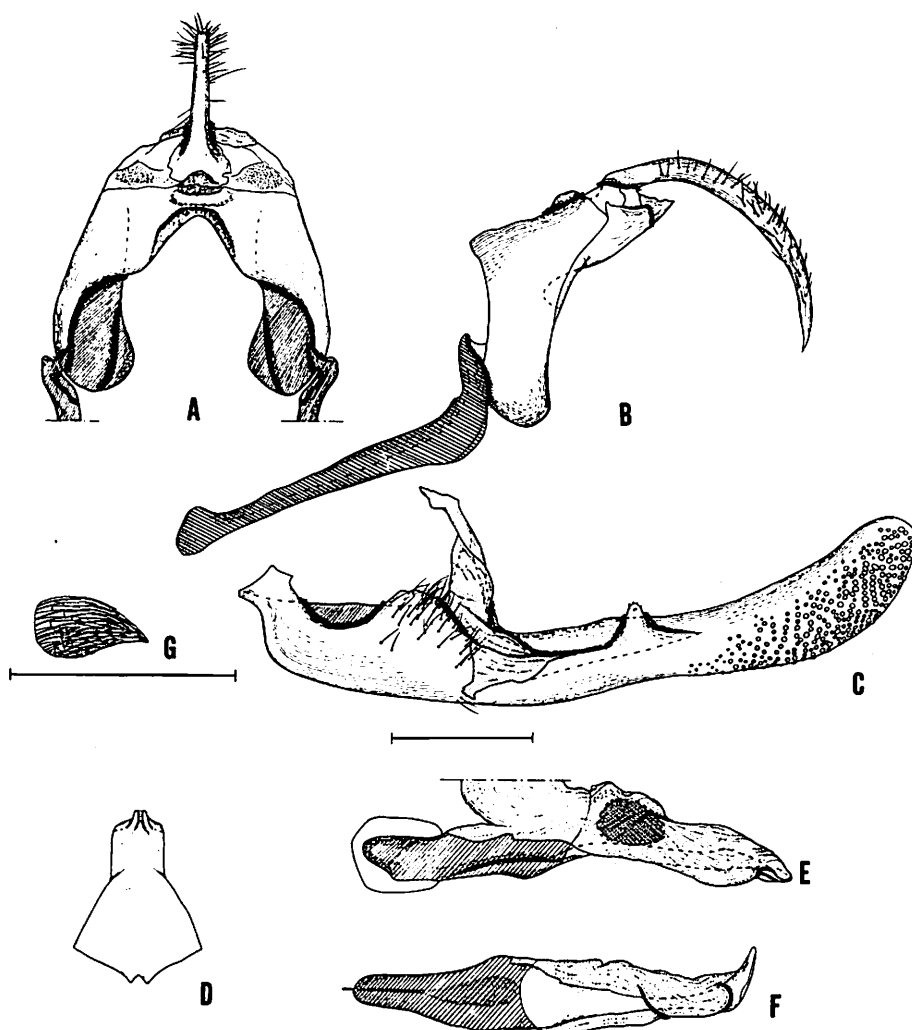


Fig. 45. Male external genitalia of *Koyaga numisma* (STAUDINGER).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. G: Cornuti. Scales 0.5 mm.

fuscous on basal half, with a slender white line through them, on apical half chequered with fuscous and white.

Underside of fore wing: Dark brown tinged with white and ochreous on the costal area; cilia same as the upper side.

Underside of hind wing: White irrorated with brown and pale yellow; a dark brown discoidal spot, minutely waved postmedial line and terminal line; cilia same as the upper side.

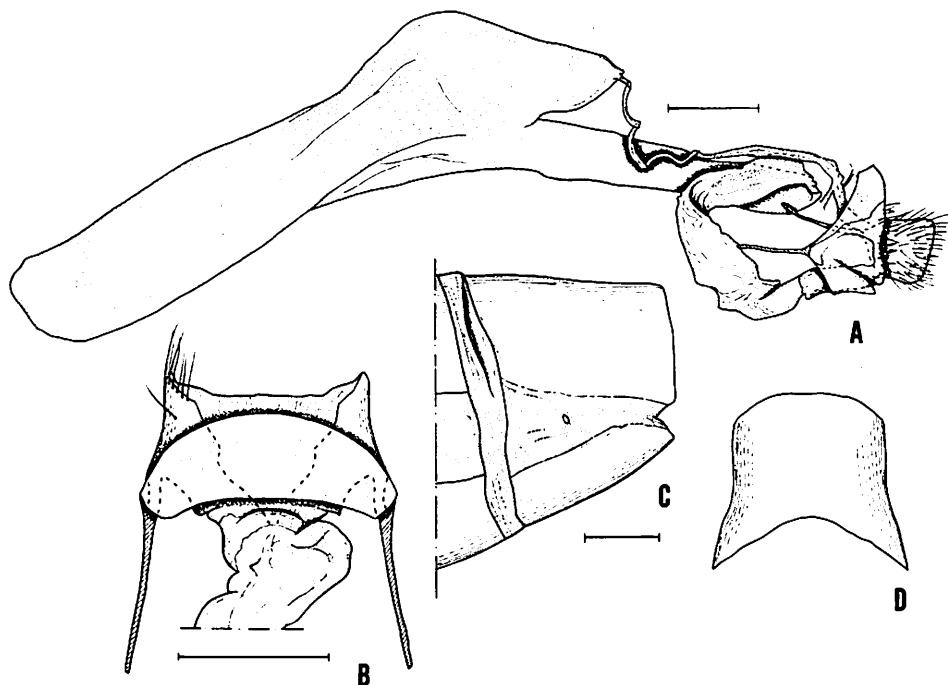


Fig. 46. Female genitalia and terminalia of *Koyaga numisma* (STAUDINGER).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scales 0.5 mm.

Male external genitalia: Tegumen large; posterior portion of tegumen weakly sclerotized; fenestrula rather small, well sclerotized and strongly concaved at the middle; very small punctures near fenestrula; vinculum broad, long, as deep as tegumen and with a keel-like inner ridge along the middle of vinculum; saccus moderately large. Uncus broad, long, falcate and sparsely short-haired. Valva very long, almost 9 times as long as medially wide; costa narrow, abruptly descending ventrally on the basal portion; the dorsal margin of harpe with a process, which projects beyond the dorsal margin of valva and bearing small denticles on its apical portion; the distal portion of cucullus + harpe evenly curved dorsally and ended in a rounded distal margin; apical portion of cucullus + harpe densely covered with broad scales bearing large sockets; sacculus moderately broad, with dorsal margin concaved at the middle, then strongly swollen beyond it. Juxta large, widened at ventral 1/2, much tapering ventrally to a pair of small subventral processes, gradually tapering to quadrate dorsal portion bearing a small apical process. Phallus almost straight; ventral sclerotized portion of suprazonal sheath rather narrow; a large ventral depression on subzonal sheath beyond the middle; coecum large, 1/3 as long as subzonal sheath and with a large keel-like muscle attachment. Cornutus represented by large rounded plate bearing long and acute spines densely.

Female terminalia: Seventh abdominal segment tapering posteriorly; posterior margin of 7th abdominal sternum evenly curved.

Female genitalia: Eighth abdominal tergum reduced to slender lateral sclerites; apophysis anterioris as long as the 8th abdominal tergum; the ventral portion of copulatory cavity weakly sclerotized; lamella antevaginalis narrow. Ductus bursae longer than corpus bursae, projected dorsally in a twisted form, then straight beyond the middle. Ductus seminalis almost 1/2 as long as ductus bursae and slender. Corpus bursae simple; cervix bursae short, 1/4 as long as corpus bursae. Papilla analis quadrate, and long-haired; apophysis posterioris a little longer than apophysis anterioris.

Specimens examined: [Korea] 1 ♂, Mt. Sudosan (700 m alt.), Kyongsangpuk-do, 9-12. vii. 1971, K. YAMAGISHI leg. (KMNHIR000, 086); [Japan] 1 ♂, Shimokita, Aomori Pref., 7. viii. 1957, T. SAIGUSA leg. (KMNHIR000, 087); 1 ♂, Mt. Akiba, Niigata Pref., 23. v. 1959, R. SATO leg. (KMNHIR000, 088); 1 ♂, Miomote, Niigata Pref., 23. vii. 1974, A. SEINO leg. (KMNHIR000, 089); 1 ♂, Kureko, Kumamoto Pref., 3. vi. 1976, K. ÔHARA leg. (KMNHIR000, 090); 1 ♀, Mt. Kakuda, Niigata Pref., 17. vi. 1972, A. SEINO leg. (KMNHIR000, 091); 1 ♀, Kureko, Kumamoto Pref., 3. vi. 1976, K. ÔHARA leg. (KMNHIR000, 092).

Distribution: USSR, China, Korea and Japan.

4-3. *Koyaga virescens* (SUGI, 1958) (Figs., 47, 48, 87-A)

Jaspidia virescens SUGI, 1958, *Tinea* 4(1): 225, figs. 7, 11.

Jaspidia virescens: INOUE & SUGI, 1958, Check List of the Lepid. Japan 5: 545.

Lithacodia virescens: SUGI, 1982, In INOUE, H. et al., Moths of Japan 1: 816, 2: 383, pl. 197: 30-31.

Length of fore wing: 8-11 mm.

Frons white mixed with dark brown; a brownish portion between scapes; vertex more whitish; labial palpus dark brown, tipped with ochreous on 2nd and 3rd segments; antenna brown ringed with ochreous. Thorax dark brown mixed with white and sparsely tinged with rufous; pleural area white; legs dark brown mixed with white; tarsi banded with ochreous. Abdomen dark brown sparsely tinged with rufous, and with white segmental lines; ventral portion of abdomen fuscous and more whitish; dorsal crests black, present on 3rd to 5th segments and slightly tipped with white.

Fore wing: Dark brown sparsely tinged with rufous and suffused with olive-brown especially on medial and subterminal areas; subbasal line dark brown, slightly defined by white on outer side and oblique from costa; antemedial line rather broad, sinuous, white and weakly defined by dark brown on outer side; claviform and orbicular with white annuli, which are fused each other and form oblique figure 8-shaped mark; a diffused olive-brown medial area below claviform; median shade dark brown with a large olive-brown patch on the middle; reniform with white annulus, defined by dark brown and

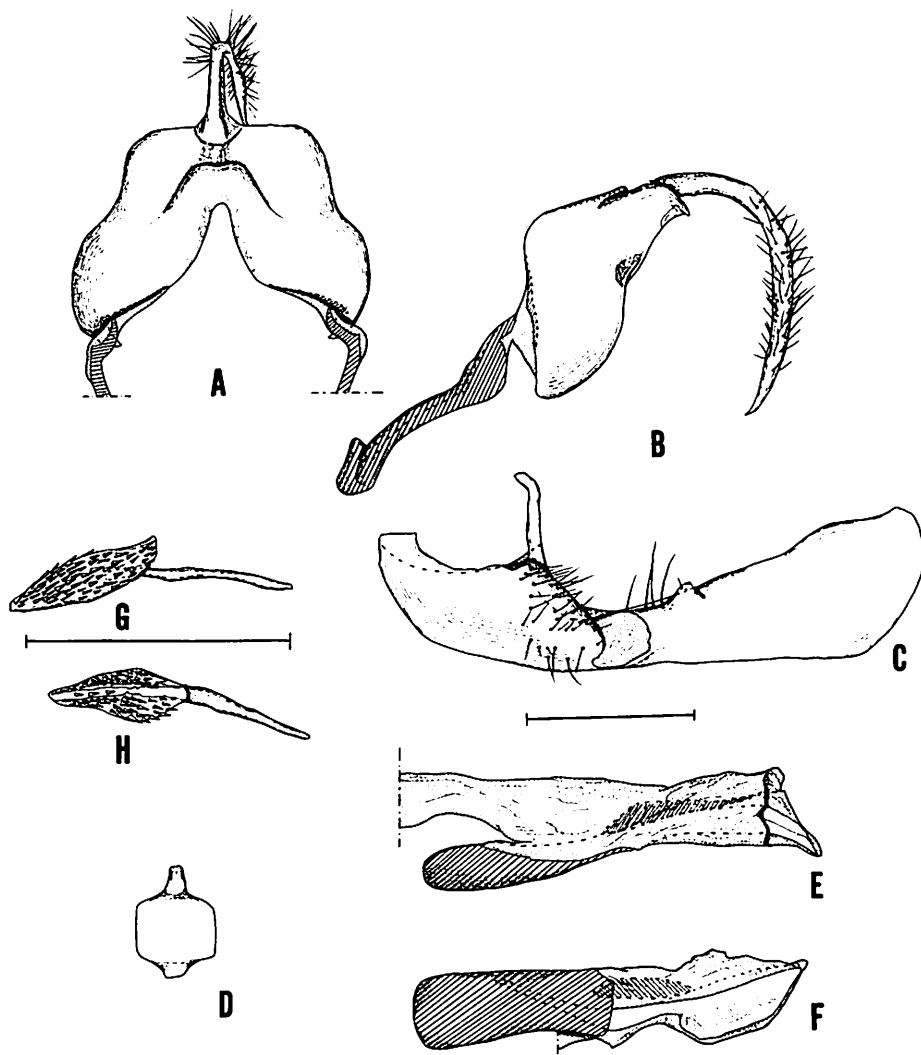


Fig. 47. Male external genitalia of *Koyaga virescens* (Sugi).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. G: Cornuti in lateral view (left). H: Cornuti in dorsal view. Scales 0.5 mm.

almost elliptical; postmedial line dark brown, indistinct between costa and vein 8, minutely waved from veins 8 to 4, then incurved; a dark brown patch below vein 5 on postmedial area; 3 white costal spots beyond it; a dark brown apical patch; subterminal line white, angled outwards at vein 7 and sinuous; terminal line dark brown, interrupted by veins; cilia fuscous, chequered with white at veins.

Hind wing: White irrorated with golden brown; fuscous terminal series; cilia fuscous

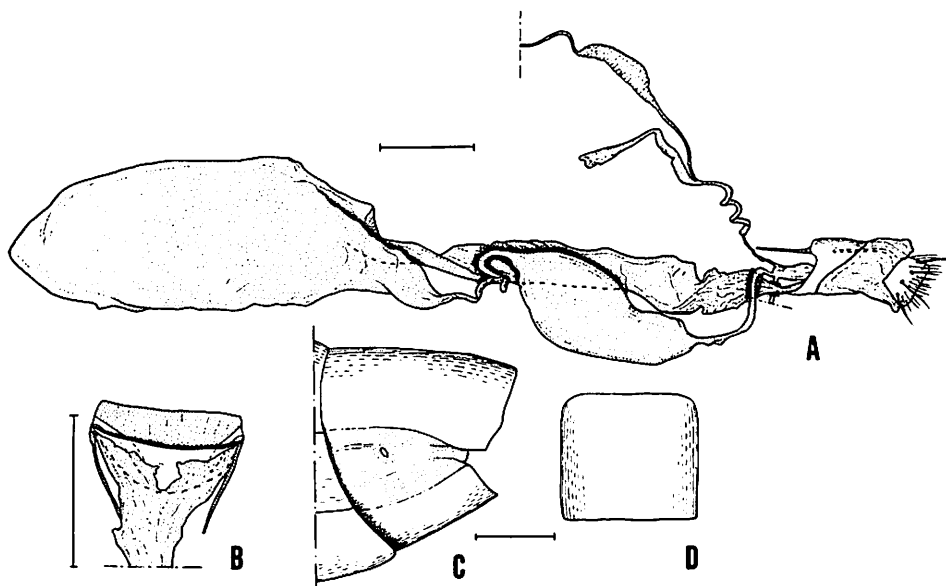


Fig. 48. Female genitalia and terminalia of *Koyaga virescens* (SUGI).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scales 0.5 mm.

on basal half and with a basal white line through them, on apical half fuscous chequered with white.

Underside of fore wing: White irrorated with dark brown, tinged with ochreous on costa; in some specimens a faint ochreous line from costa to inner to margin on subterminal area.

Underside of hind wing: White, sparsely tinged with dark brown and more brownish beyond postmedial line; dark brown discoidal spot and minutely waved postmedial line; a dark brown terminal series.

Male external genitalia: Tegumen, moderately broad and evenly sclerotized; fenestrula indistinct and concaved at the middle; peniculus moderately large; vinculum $2/3$ as deep as tegumen and with a keel-like inner ridge; saccus small, produced dorsally. Uncus long, slender, falcate and sparsely long-haired beyond the basal $1/3$. Valva long, 7 times as long as medially wide; costa narrow, abruptly descending ventrally on the basal portion; the dorsal margin of harpe with a small process, which slightly projects beyond the dorsal margin of valva and bears small denticles; cucullus + harpe gradually and almost evenly dilating towards rounded distal margin; sacculus broad and simple, with dorsal margin swollen beyond the middle. Juxta quadrate with narrow ventral and dorsal extensions respectively. Phallus gently curved dorsally beyond zone and curved ventrally on the apical portion; ventral sclerotized portion of suprazonal sheath narrow

and dilating laterally from the middle to the apex; coecum small, $1/3$ as long as the subzonal sheath; cornutus represented by an almost elliptical plate with a slender sclerotized bar, the plate swollen at the middle and with many denticles.

Female terminalia: Seventh abdominal segment tapering posteriorly; its sternum almost quadrate, parallel-sided.

Female genitalia: Eighth abdominal tergum decreasing its length laterally and well sclerotized; apophysis anterioris slender, as long as the dorsal margin of 8th abdominal tergum; lamella postvaginalis absent; copulatory cavity wide, its ventral portion sclerotized along the posterior margin. Ductus bursae moderately broad and as long as corpus bursae. Ductus seminalis $5/3$ as long as ductus bursae and its middle portion strongly bulged. Corpus bursae simple; cervix bursae small, $1/3$ as long as corpus bursae. Signa absent. Papilla analis oblong, dilating towards posterior distal margin and sparsely long-haired; apophysis posterioris 1.5 times as long as apophysis anterioris.

Specimens examined: [Taiwan] 1 ♂, Tamonkei, Mt. Taiheizan (Taihoku-shu), 23. vii. 1932, T. ESAKI leg. (ELKU); [Japan] 1 ♂, Iwama Hot Spring, Ishikawa Pref., 5–7. viii. 1972, K. TANAKA leg. (KMNHIR000, 093); 1 ♂, Sakasamaki, Niigata Pref., 15. vii. 1963, R. SATO leg. (KMNHIR000, 094); 1 ♂, Mt. Takao-san, Tokyo, 15. vi. 1952, S. SUGI leg. (paratype in SUGI Collection); 1 ♀, Iwama Hot Spring, Ishikawa Pref., 5–7. viii. 1972, K. TANAKA leg. (KMNHIR000, 095); 1 ♀, Lake Aoki-ko (820 m alt.), Nagano Pref., 5–9. ix. 1974, H. YOSHIMOTO leg. (KMNHIR000, 096).

Distribution: Taiwan and Japan.

4–4. *Koyaga senex* (BUTLER, 1881) (Figs., 49, 50, 87–B)

Erastria senex BUTLER, 1881, *Trans. Ent. Soc. Lond.* 1881: 189.

Lithacodia senex: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 534.

Jaspidia senex: INOUE & SUGI, 1958, *Check List of the Lepid. Japan* 5: 545.

Lithacodia senex: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 816, 2: 383, pl. 197: 26–27.

Length of fore wing: 9–12 mm.

Frons black; apical portion of frons and vertex white; a black bar between scapes; labial palpus black; antenna black with white lines. Thorax black; collar black mixed with white and ochreous; large white patch on tegula, scutum and scutellum; pleural area white; fore leg black in front; tibia and tarsus ringed with white; mid and hind legs fuscous; mid and hind tibiae and tarsi white ringed with black. Abdomen fuscous with broad white segmental rings, more whitish on caudal and ventral portions; dorsal crests on 3rd to 5th segments and black.

Fore wing: Olive-brown; a large black patch on the base of costa, a black band from it to inner margin, angled inwards on vein 1 and outwards above inner margin; subbasal line white, indistinct; antemedial line white, running outwards from costa, then sinuous

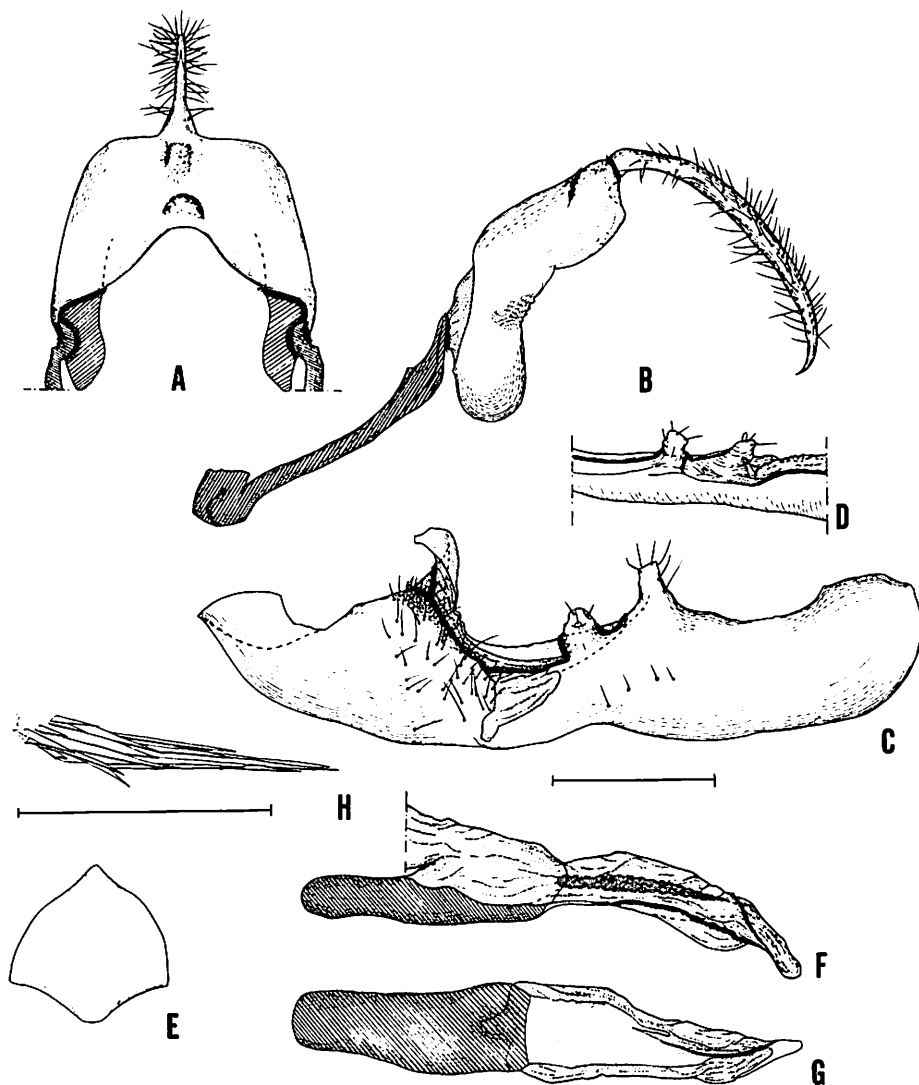


Fig. 49. Male external genitalia of *Koyaga senex* (BUTLER).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Dorsal margin of right cucullus + harpe, showing two processes, in dorsal view. E: Juxta. F: Phallus in lateral view (left). G: Phallus in ventral view. H: Cornuti. Scales 0.5 mm.

below median fold to inner margin; orbicular and claviform each with a white annulus, the both two united at middle forming oblique figure of 8-shaped; a large black patch below claviform; median shade black, suffused with olive-brown at middle, and enlarged to costa; reniform white and dilating at the base; postmedial line white, slightly defined by

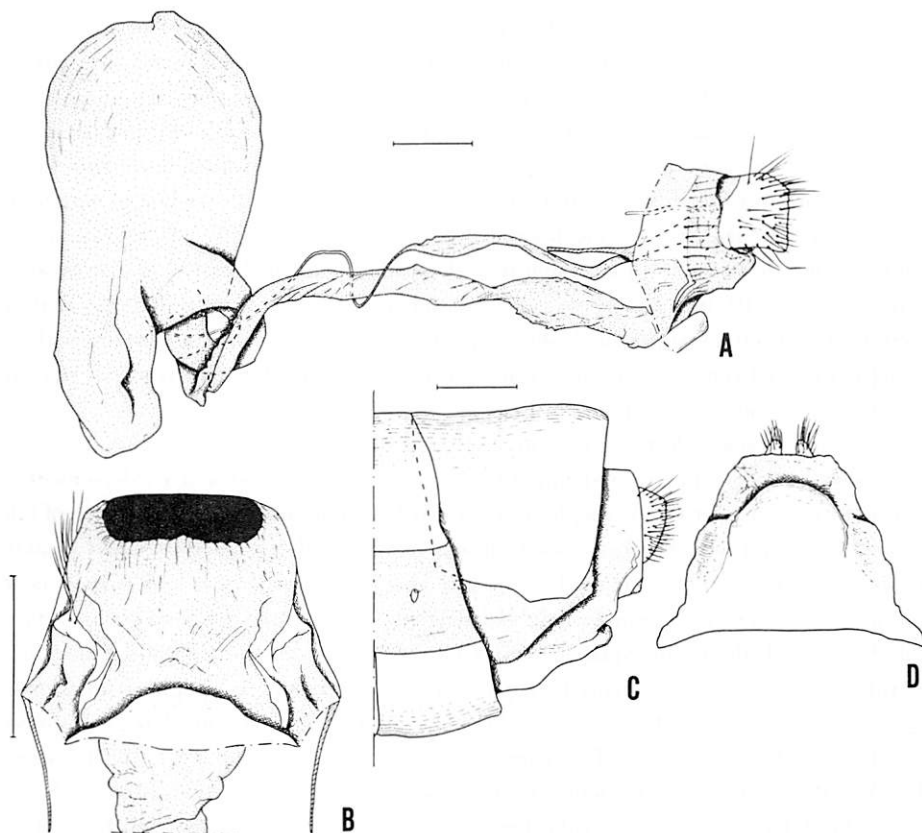


Fig. 50. Female genitalia and terminalia of *Koyaga senex* (BUTLER).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scales 0.5 mm.

black on inner side, hardly traceable, dentate from costa to vein 3, then angled inwards to vein 2 and almost straight to inner margin; a black apical patch excurved below costa; subterminal line white, angled outwards at vein 7, then diffused and widened, angled inwards at vein 3 and straight below vein 2; a short black streak beyond subterminal line below vein 4; terminal line faint black striga, interrupted on each vein; cilia white, with black patches at apex, middle and tornus.

Hind wing: Brown irrorated with white; cilia white with brown line through them.

Underside of fore wing: Brown; costal area tinged with olive-brown.

Underside of hind wing: White, sparsely mixed with brown on the costal area; discoidal spot brown; postmedial line brown and minutely wavy.

Male external genitalia: Tegumen moderately broad and evenly sclerotized; a dorsomedian concaved area each present on tegumen and fenestrula; peniculus developed

ventrally; vinculum long, almost as deep as tegumen; saccus quadrate and large. Uncus simple, long, falcate and sparsely long-haired, ending in an acute tip. Valva long, about 7 times as long as medially wide; costa narrow, abruptly descending ventrally on the basal portion; cucullus + harpe broad, gently curved dorsally, ending in rounded distal margin and with narrow and distinct dorsal ridge on its basal 1/3, which bears two large processes; sacculus broad, its dorsal margin concaved and fused with the lateral margin of juxta on the subbasal portion, much swollen dorsally beyond middle, which bears many denticles and short hairs. Juxta almost oval, acutely pointed dorsally, and excavated ventrolaterally. Phallus almost straight and subapically curved ventrally; the ventral sclerotized portion of suprazonal sheath moderately broad; subzonal sheath with a strongly concaved ventral groove near zone; cornutus represented by an irregularly shaped plate with many long acute spines.

Female terminalia: Posterior margin of 7th abdominal sternum rounded.

Female genitalia: Eighth abdominal tergum weakly sclerotized and its dorsomedian portion broadly desclerotized; apophysis anterioris long and aubequal to the length of 8th abdominal tergum; lamella postvaginalis absent; ventral wall of copulatory cavity weakly sclerotized. Ductus bursae long, 1.5 times as long as corpus bursae and twisted near corpus bursae. Ductus seminalis long and slender. Corpus bursae short; cervix bursae rather long and almost subequal to corpus bursae. Signa absent. Papilla analis well sclerotized and sparsely long-haired; apophysis posterioris as long as apophysis anterioris.

Specimens examined: [Japan] 1 ♂, Shimokita, Aomori Pref., 1. viii. 1957, T. SAIGUSA leg. (KMNHIR000, 097); 1 ♂, Uodomenotaki, Niigata Pref., 4–5. vii. 1976, A. SEINO leg. (KMNHIR000, 098); 1 ♂, Uodomenotaki, Niigata Pref., 21. vii. –1. viii. 1976, A. SEINO leg. (KMNHIR000, 099); 1 ♂, Gifu Pref., 20. viii. 1921, SAKUCHI leg. (ELKU); 1 ♂, Kibune, Kyoto Pref., 1. vi. 1918, I. SUGITANI leg. (ELKU); 1 ♂, Uchino, Fukuoka Pref., 29. viii. 1965, M. ŌBA leg. (KMNHIR000, 100); 1 ♂, Chōjabaru, Mt. Kuju, Ōita Pref., 7. vi. 1978, K. SETOYA leg. (KMNHIR000, 101); 2 ♂♂, Mt. Sobosan, Ōita Pref., 29. vi. 1932, HORI, FUJINO & CHO leg. (ELKU); 1 ♀, Okutainai, Niigata Pref., 26. vi. 1971, A. SEINO leg. (KMNHIR000, 102); 1 ♀, Uodomenotaki, Niigata Pref., 24–25. vii. 1976, A. SEINO leg. (KMNHIR000, 103); 1 ♀, Mt. Kurama, Kyoto Pref., 9. vi. 1923, I. SUGITANI leg. (ELKU).

Distribution: Japan.

4–5. *Koyaga viriditincta* (WILEMAN, 1915) (Figs., 51, 87–C)

Lithacodia viriditincta WILEMAN, 1915, *Entomologist* 48: 160.

Length of fore wing: 11 mm.

Head white; labial palpus fuscous tipped with white on 2nd and 3rd segments; antenna fuscous ringed with white. Thorax fuscous mixed with white; pleural area white;

legs fuscous; tarsi banded with white. Abdomen fuscous with white segmental lines; the caudal portion of abdomen ochreous; dorsal crests on 3rd and 4th segments, fuscous tipped with white.

Fore wing: Olive-brown tinged with white; the basal area of costa dark brown

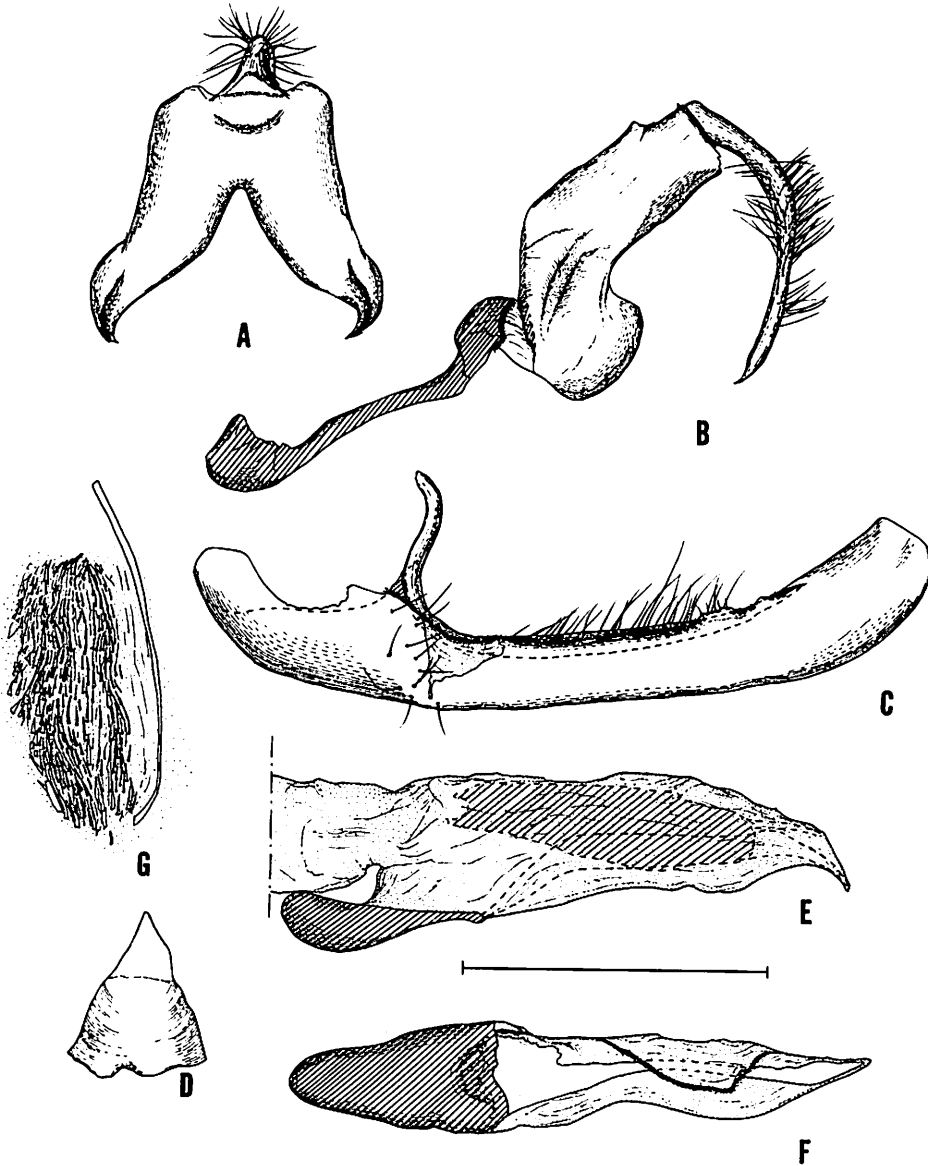


Fig. 51. Male external genitalia of *Koyaga viriditincta* (WILEMAN).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. Scale 1 mm.

irrorated with white; a narrow dark brown band from costa, angled outwards on vein 1 and oblique to inner margin; the subbasal line represented by white striga and running from costa to inner margin; antemedial line represented by white striga, angled inwards on discoidal cell and indistinct between vein 1 and inner margin; claviform and orbicular stigmata white, large and semicircular, united with each other, forming oblique figure of 8-shaped mark; reniform defined by white, oval and constricted at the middle; median shade dark brown and reaching to costa; postmedial line white, irregularly defined by dark brown from costa to vein 4, then hardly traceable, dentated and incurved from vein 1 to inner margin; some olive-brown and white spots on costa beyond it; a large dark brown apical patch; subterminal line white, sinuous and indistinct between veins 6 and 4; a short dark brown streak beyond subterminal line below vein 6; terminal line dark brown, interrupted by olive-brown on each vein; cilia fuscous mixed with some white scales.

Hind wing: White slightly irrorated with pale brown; cilia fuscous with a white line at base through them.

Underside of fore wing: White irrorated with brown; costal area strongly suffused with brown.

Underside of hind wing: White sparsely irrorated with brown; small discoidal spot and postmedial line brown, the latter minutely waved and running almost parallel to termen.

Male external genitalia: Tegumen broad, thick and evenly sclerotized; fenestrula indistinct and slightly concaved at the middle; in lateral view a broad, deep, vertical groove on ventrad 1/2 of tegumen; peniculus well developed, and rounded distally; vinculum long, 1/2 as deep as tegumen; saccus large and produced dorsally. Uncus long and slender, sparsely long-haired on middle 1/2, and ended in an acute tip. Valva very long, about 9 times as long as medially wide; costa long and narrow, abruptly descending ventrally on the basal portion; harpe very long, occupying basal 2/3 of cucullus + harpe, bearing small irregular dentations dorsodistally; apical portion of cucullus + harpe curved dorsally and ending in truncate distal margin; sacculus rather broad, with ventroproximal margin gently curved dorsally. Juxta triangular and swollen at the middle. Phallus curved dorsally beyond the zone, then straight, curved ventrally near apical portion and ended in an acute tip; the ventral sclerotized portion of suprazonal sheath very narrow; subzonal sheath with strong concaved semicircular ventral area near zone; coecum large, 1/2 as long as subzonal sheath; cornutus represented by a long slender sclerite and many minute spines.

Female: Unknown to me.

Specimens examined: [Taiwan] 1 ♂, Mt. Rarashan, 16.vii.1939, K. ENDO leg. (ELKU); 3 ♂♂, Mt. Rarashan, 1979, S. KOH leg. (KMNHIR000, 104–106); 1 ♂, Mt. Rarashan, vi. 1968, (KMNHIR000, 107).

Distribution: Taiwan.

4-6. Phylogenetic relationships in the genus *Koyaga*.

This genus consists of five species, i. e., *falsa*, *numisma*, *virescens*, *senex* and *viriditincta*. It is characterized by the following autapomorphies; (1) hairs of male antenna is long and (2) male phallic cornutus is represented by a sclerotized plate bearing long acute spines. However, the phylogenetic relationships among five species are now uncertain as mentioned in the section 3-2-3 (part 1: p. 10). The research on new character-states will be needed in future for this problem as in the case of the genus *Protodeltote*.

5. Genus *Deltote* R. L., 1817

Key to the species

Male

1. Valva with a distinct process on the dorsal margin of cucullus + harpe 2
- Valva without processes on the dorsal margin of cucullus + harpe 3
2. Process of sacculus long and projecting dorsally beyond costa *bellicula*
- Process of sacculus not developed *uncula*
3. Fenestrula sclerotized; process of sacculus short and not projecting dorsally beyond costa 4
- Fenestrula membranous; process of sacculus well developed and projecting dorsally beyond costa *nemorum*
4. Fenestrula distinctly separated from tegumen by weakly sclerotized narrow portion; anterior portion of peniculus pointed *bankiana*
- Fenestrula indistinct; anterior portion of peniculus rounded *deceptoria*

Female

1. Seventh abdominal tergum short, occupying posterior part of dorsum of the segment, or much desclerotized anterolaterally 2
- Seventh abdominal tergum well developed, broad, occupying most part of dorsum of the segment *bellicula*
2. Seventh abdominal tergum occupying posterior 1/2 of the segment 3
- Seventh abdominal tergum almost as long as the segment, but largely excavated anterolaterally *deceptoria*
3. Membranous incision of 8th abdominal tergum narrow 4
- Membranous incision of 8th abdominal tergum broad *uncula*
4. Seventh abdominal sternum triangular; copulatory cavity narrow *nemorum*
- Seventh abdominal sternum trapezoidal; copulatory cavity broad *bankiana*

5-1. *Deltote nemorum* (OBERTHÜR, 1880)

(Figs., 52, 53, 87-D)

Erastria nemorum OBERTHÜR, 1880, *Ét. Ent.* 5: 82, pl. 4, fig. 2.

Erastria africana: LEECH, 1889 (nec C. et R. FELDER, 1875), *Proc. Zool. Soc. Lond.* 1889: 525.

Lithacodia nemorum: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 536.

Jaspidia nemorum: INOUE & SUGI, 1958, *Check List of the Lepid. Japan* 5: 545.

Lithacodia nemorum: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 816, 2: 383, pl. 197: 28–29.

Length of fore wing: 9–11 mm.

Frons dark brown slightly mixed with ochreous and rufous; vertex dark brown; labial palpus dark brown tipped with ochreous white on 2nd and 3rd segments; antenna dark brown. Thorax with dark brown scales, which are tipped with white; pleural area white; legs dark brown mixed with ochreous white; hind leg more whitish; tarsi dark brown, banded with ochreous white. Abdomen dark brown mixed with white; segmental lines ochreous white; dorsal crests on 1st to 4th segments and black.

Fore wing: Fuscous brown; subbasal line represented by dark brown striae from costa to discal cell; antemedial line dark brown, sinuous, excurved below costa, at submedian fold and below vein 1; claviform and orbicular stigmata defined by dark brown at extremities but indistinct; a dark brown median shade; reniform with white annulus, which is almost elliptical and open below; postmedial line white, defined by dark brown below vein 6, angled outwards to vein 7, minutely waved, strongly incurved below vein 6 and erect below vein 2; 3 white spots on costa beyond it; postmedial area white on the

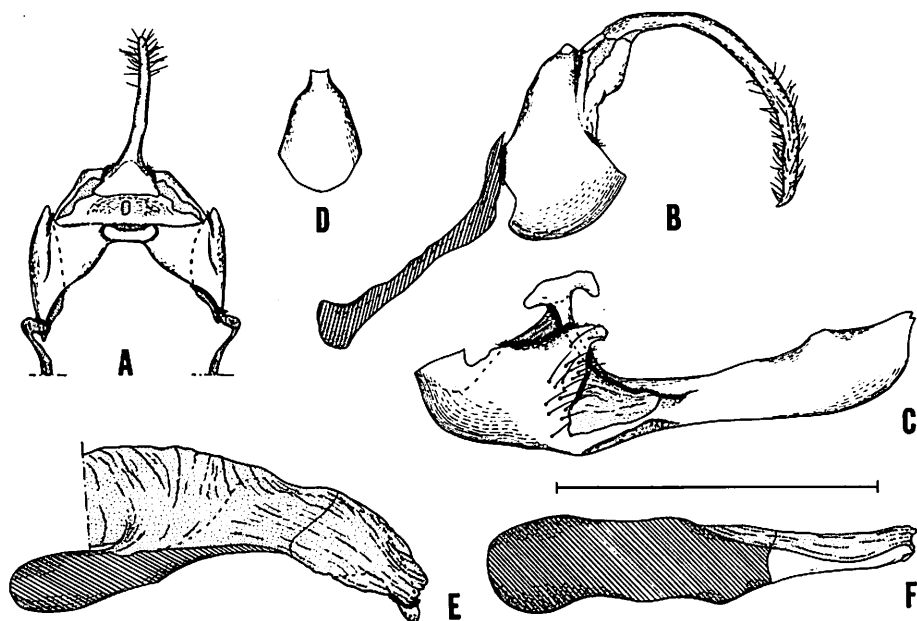


Fig. 52. Male external genitalia of *Deltote nemorum* (OBERTHÜR).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. Scale 1 mm.

inner half and suffused with fuscous brown scales; subterminal line white, indistinct and excurved below vein 7 and at the middle; subterminal area tinged with reddish brown; a terminal series of dark brown striae; cilia dark brown mixed with white.

Hind wing: White irrorated with dark brown; cilia white with a dark brown line at the base.

Underside of fore wing: White irrorated with dark brown; costal area tinged with ochreous and reddish brown; terminal series of dark brown striae.

Underside of hind wing: White sparsely mixed with dark brown; apical portion of costa tinged with reddish brown; a discoidal spot and waved postmedial line dark brown.

Male external genitalia: Tegumen moderately large; fenestrula large, concaved and with a rather broad membranous area at middle; in lateral view a deep groove running from fenestrula to middle of tegumen and a long and narrow membranous incision running almost parallel to the groove from the base of uncus; peniculus developed; vinculum narrow and as deep as tegumen; saccus small and truncated. Uncus long, falcate, sparsely short-haired on apical half and ended in an acute tip. Valva long, 6 times as long as medially wide; costa narrow, strongly descending ventrally at the basal half; the base of costa irregularly projecting laterally; cucullus + harpe without processes or denticles, almost straight and ended in a dentated tip; sacculus broad and its dorsodistal portion projecting posterodistally beyond costa and ended in a blunt tip, which bears small denticles sparsely. Juxta rather small and tapering to truncated posterior margin. Phallus curved ventrally; the ventral sclerotized portion of suprazonal sheath narrow; coecum large, $1/3$ as long as subzonal sheath and rounded distally; cornuti absent.

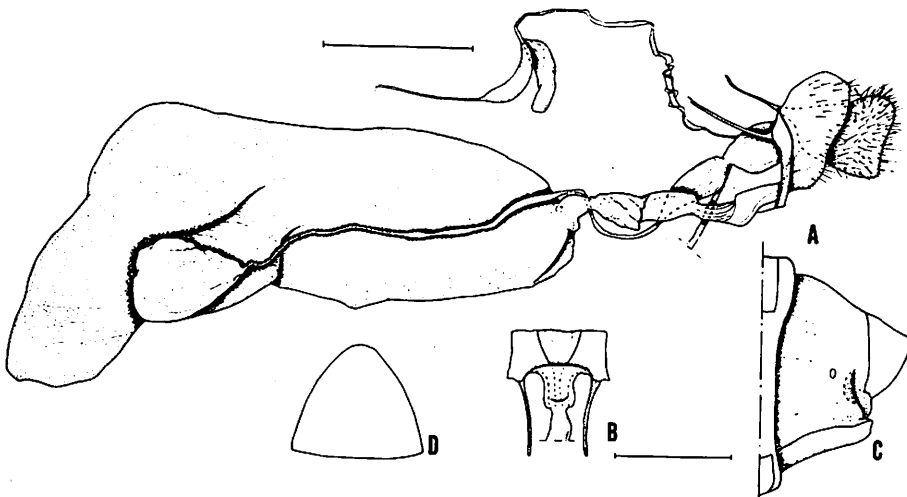


Fig. 53. Female genitalia and terminalia of *Deltote nemorum* (OBERTHÜR).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scales 1 mm.

Female terminalia: Seventh abdominal segment strongly tapering posteriorly; anterior membranous portion of 7th abdominal dorsum broad, and 7th tergum reduced to about 1/3 of the 7th abdominal dorsum; lateral depression large and fold-like in shape; 7th abdominal sternum triangular and ended in roundly produced posterior margin.

Female genitalia: Eighth abdominal tergum evenly sclerotized, but with narrow membranous incision anteroventrally; copulatory cavity narrow, well sclerotized and with shallow depression on its ventral portion; apophysis anterioris long, 2 times as long as 8th abdominal tergum. Ductus seminalis long, 3 times as long as ductus bursae and slender. Corpus bursae large, T-shaped in dorsal view. Signa absent. Papilla analis triangular and sparsely long-haired.

Specimens examined: [Japan] 1 ♂, Sugigawa, Niigata Pref., 22. vi. 1962, R. SATO leg. (KMNHIR000, 110); 1 ♂, Mt. Kakuda, Niigata Pref., 17. vi. 1972, A. SEINO leg. (KMNHIR000, 111); 1 ♂, Harayama, Gifu Pref., 10. vi. 1975, H. ENDO leg. (KMNHIR000, 112); 1 ♂, Kurama, Kyoto Pref., 27. vi. 1925, I. SUGITANI leg. (ELKU); 1 ♀, Kurama, Kyoto Pref., 23. vi. 1925, I. SUGITANI leg. (ELKU).

Distribution: USSR, China, Korea and Japan.

5-2. *Deltote uncula* (CLERK, 1759)
(Figs., 19, 20-C, F, 21-C, F, 28-C)

Phalaena uncula CLERK, 1759, Icones., pl. 3, fig. 7.

Tortrix unca DENIS & SCHIFFERMÜLLER, 1775, Ankündigung syst. Werkes Schmett. Wienergegend: 91.

Eustrotia uncula: HAMPSON, 1910, Cat. Lepid. Phalaenae Br. Mus. 10: 578, fig. 161.

Unca uncula: INOUE & SUGI, 1958, Check List of the Lepid. Japan, 5: 547.

Eustrotia uncula: KARSHOLT & NIELSEN, 1976, Systematisks fortegnelse over Danmarks sommerfugle: 71.

Eustrotia uncula: SUGI, 1982, In INOUE, H. et al., Moths of Japan 1: 814, 2: 383, pl. 197: 4-5.

Length of fore wing: 11 mm.

Head brown mixed with rufous and white; antenna covered with rufous scales dorsally, reddish brown ventrally; labial palpus brown mixed with white. Thorax brown dorsally; pleural area almost whitish; tarsi brown ringed with white. Abdomen brown mixed with white.

Fore wing: Subbasal and antemedial lines indistinct; a broad brown streak below costa, slightly defined by rufous on each side, running between the base of wing and the postmedial line; the distal half of this line suffused with pale rufous; orbicular represented by a white spot; reniform represented by oblique oblong marking with white annulus; a creamy white streak from upper angle of reniform to postmedial line; postmedial line dark brown defined by white on outer side and bounding the deep brown area mixed with rufous, running from near the stalked point of veins 8 and 9 and oblique to inner margin; subterminal line brown, defined on each side by white, running almost parallel to postmedial line from the apical triangular shade to inner margin; terminal line dark

brown; cilia white with two fuscous lines through them.

Hind wing: Pale reddish brown cilia white with fuscous line through them.

Underside of fore wing: Pale grey mixed with white; the costal area tinged with rufous.

Underside of hind wing: White and sparsely mixed with brown; a small discoidal spot brown.

Male external genitalia: Tegumen moderately broad and separated into strongly sclerotized anterior portion and weakly sclerotized posterior portion; fenestrula broad, concaved and well sclerotized; peniculus well developed, and with rounded ventral margin; vinculum slender, as deep as tegumen; saccus small, rounded. Uncus long, sinuated and strongly swollen on distal half, densely long-haired, weakly clavate apically and bearing an acute and small spine at tip. Valva long, about 6 times as long as medially wide; costa narrow, abruptly descending ventrally at the basal portion; the base of costa projecting laterally; cucullus + harpe with a large dorsal process at the middle, obliquely projecting dorsally and ending in a blunt tip; sacculus narrow, without processes, but very small dentations at the posterodistal portion of sacculus. Juxta large, almost triangular and moderately swollen ventromedially. Phallus strongly curved ventrally; the ventral sclerotized portion of suprazonal sheath moderately broad; coecum large, 1/2 as long as subzonal sheath and rounded at the distal margin; cornuti absent.

Female terminalia: Seventh abdominal segment not tapering through its length; 7th abdominal tergum reduced to posterior 1/2 of the 7th abdominal dorsum, and tapering ventrally; lateral depression large and fold-like shape; posterior margin of 7th abdominal sternum rounded.

Female genitalia: Eighth abdominal tergum with large membranous incision laterally; copulatory cavity broad, entirely sclerotized and with small triangular depression on its ventral portion; apophysis anterioris as long as the 8th abdominal tergum. Ductus seminalis long, 3 times as long as ductus bursae and slender. Corpus bursae long and hook-shaped. Signa absent. Papilla analis large, sparsely long-haired, with rounded dorsal margin and with weakly concaved posterior margin.

Specimens examined: [Denmark] 1 ♂, Risager Pl., Denmark, 20. v. 1945, B. SØRENSEN leg. (KMNHIR000, 113); [Finland] 1 ♂, Fennia. Ta. Lahti, Finland, 26. viii. 1955, HEINÄNEN leg. (KMNHIR000, 114); [Denmark] 1 ♀, Laensballe Ld., Denmark, 8. vii. 1945, B. SØRENSEN leg. (KMNHIR000, 115); [Finland] 1 ♀, Kuolemajärvi, Finland, 3. vii. 1932, M. LVASCHINZEFF leg. (KMNHIR000, 116); [Japan] 1 ♂, Mt. Hikosan, Fukuoka Pref., 28. viii. 1932, (ELKU).

Distribution: Europe, USSR and Japan.

5-3. *Deltote bellicula* (HÜBNER, 1818)

(Figs., 18, 20-B, E, 21-B, E, 28-B)

Lithacodia bellicula HÜBNER, 1818, Zuträge Samml. exot. Schmett. 1: 18, figs. 85, 86.

Lithacodia bellicula: HAMPSON, 1910, Cat. Lepid. Phalaenae Br. Mus. 10: 520, fig. 150.

Erastria bellicula: McDUNNOUGH, 1938, *Mem. South. Cal. Acad. Sci.* 1: 109.

Lithacodia bellicula: FRANCLEMONT & TODD, 1983, In HODGES R. W. et al., *Check List of Lepid. America North of Mexico*: 132.

Length of fore wing: 9–12 mm.

Head rufous; labial palpus rufous mixed with brown; antenna rufous ringed with pale grey. Thorax rufous, its posterior portion brown; pleural area whitish; legs rufous mixed with brown; tarsi banded with ochreous. Abdomen pale grey with white segmental lines; dorsal crests on 3rd and 4th segments black and tipped with white.

Fore wing: Rufous mixed with brown; bright rufous between antemedial line and reniform stigma; subbasal line absent; orbicular with white semicircular annulus; reniform represented by a white discoidal striga; a yellowish slender bar between orbicular and reniform stigmata; postmedial line white, slightly bent outwards below costa, strongly excurved to vein 4, then angled inwards in submedian fold and oblique to inner margin; four whitish points beyond postmedial line on costa; postmedial area yellowish; subterminal line rufous mixed with yellow; terminal line fuscous; cilia white with two fuscous lines through them.

Hind wing: Grey irrorated with brown; cilia white with fuscous line through them.

Underside of fore wing: Grey irrorated with brown.

Underside of hind wing: White, sparsely irrorated with brown; discoidal spot small and dark brown.

Male external genitalia: Tegumen moderately large, separated into strongly sclerotized anterior portion and weakly sclerotized posterior portion; fenestrula concaved and weakly sclerotized at the base of uncus; peniculus well developed and its posterior portion ended in an acute tip; vinculum slender, 2/3 as deep as tegumen; saccus small. Uncus long, sinuated and moderately swollen on distal half, sparsely long-haired, and ended in a blunt tip with an acute small spine. Valva long, about 6 times as long as medially wide; costa narrow, abruptly descending ventrally on the basal half; the base of costa projecting laterally; cucullus + harpe with a triangular dorsal process at the middle, gently curved dorsally and ended in a truncated tip, which bears small denticles apically; sacculus broad and its dorsodistal portion projecting posterodistally beyond costa and ending in a blunt tip, which bears small denticles. Juxta small, flat and almost triangular. Phallus strongly curved ventrally; the ventral sclerotized portion of suprazonal sheath rather broad; coecum moderately large and rounded; cornuti absent.

Female terminalia: Seventh abdominal segment tapering posteriorly; 7th abdominal tergum well developed, broad and occupying most part of dorsum of the segment; lateral depression small; 7th abdominal sternum very narrow and almost triangular in ventral view.

Female genitalia: Eighth abdominal tergum with membranous incision on its anteroventral margin; copulatory cavity well sclerotized; apophysis anterioris as long as 8th abdominal tergum. Ductus bursae moderately long, 1/2 as long as corpus bursae.

Ductus seminalis long, 3 times as long as ductus bursae and slender. Corpus bursae large and U-shaped; cervix bursae well developed, 1/2 as long as corpus bursae. Signa absent. Papilla analis almost triangular, and bearing long hairs sparsely.

Specimens examined: [Canada] 1 ♂, Cascapedia, Quebec, Canada, 13. vi. 1933, W. J. BROWN leg. (Coll. of Biosystematics Research Institute); 1 ♀, Carp., Ontario, Canada, 5. vii. 1932, W. J. BROWN leg. (Coll. of Biosystematics Research Institute); [USA] 1 ♂, Yapahng, LI., New York, 30. v. ? (Coll. of Smithsonian Institution); 1 ♀, place unknown, 25. v. 1902, (Coll. of Smithsonian Institution).

Distribution: North America.

5-4. *Deltote bankiana* (FABRICIUS, 1775)

(Figs., 17, 20-A, D, 21-A, D, 28-A)

Pyralis bankiana FABRICIUS, 1775, Syst. Ent. :645.

Tortrix olivana DENIS & SCHIFFERMÜLLER, 1775, Ankündigung syst. Werkes Schmett. Wienergegend: 126.

Phalaena argentula HÜBNER, 1787, Beitr. Gesch. Schmett. 1 (2): 9, pl. 2, fig. F.

Eustrotia olivana: HAMPSON, 1910, Cat. Lepid. Phalaenae Br. Mus. 10: 580.

Unca olivana: INOUE & SUGI, 1958, Check List of the Lepid. Japan 5: 547.

Eustrotia bankiana: KARSHOLT & NIELSEN, 1976, Systematisk fortegnelse over Danmarks sommerfugle: 71.

Deltote bankiana: LEMPKE, 1976, Naamlijst van de Nederlandse Lepidoptera: 65.

Deltote bankiana: SUGI, 1982, In INOUE, H. et al., Moths of Japan 1:814, 2: 283, pl. 197: 6.

Length of fore wing: 10-11 mm.

Frons white mixed with olive-brown, sometimes with an olive-brown bar; vertex white mixed with olive-brown; labial palpus olive-brown, tipped with ochreous white on 2nd and 3rd segments; antenna dark brown ringed with ochreous. Thorax white, sparsely mixed with olive-brown and dark brown; collar white with a dark brown bar at the middle; tegula white with an indistinct dark brown band at the middle; posterior portion of scutellum more brownish; pleural area white legs brown mixed with ochreous white; tarsi banded with ochreous white; hind leg more whitish. Abdomen brown irrorated with white or ochreous white and with orange tufts caudally.

Fore wing: Olive-brown; a broad white subbasal streak defined by dark brown on outer side and from costa to the base of wing; an oblique broad antemedial band white, defined by dark brown on each side; outer margin of this band irregularly waved and excurved on discal cell and at submedian fold; a similar oblique postmedial band white, defined by dark brown on each side, from costa and ending at the tornus; discocellular portion of the postmedial band expanding inwards and forming a spot-like mark; a short white streak from costa, angled inwards to vein 7; a white band on subterminal area below vein 7 to vein 1; a terminal series of dark brown striae; cilia white with a dark brown line at the middle through them, and white mixed with dark brown apically.

Hind wing: White, sparsely irrorated with minute brown scales; sometimes

subterminal area suffused with brown; terminal line brown; cilia white with a brown line at the base through them.

Underside of fore wing: White irrorated with dark brown; costal area tinged with ochreous and olive-brown.

Underside of hind wing: White sparsely irrorated with dark brown; a faint discoidal spot dark brown.

Male external genitalia: Tegumen large and broad; the posterior portion of tegumen weakly sclerotized and narrow; fenestrula almost triangular, concaved medially and well sclerotized; in lateral view, a deep groove running from fenestrula to the middle portion of tegumen; peniculus well developed and anterior and posterior portions of it pointed; vinculum as deep as tegumen; saccus moderate and truncated. Uncus long, falcate, sparsely long-haired on its apical half and ending in a blunt tip bearing an acute spine. Valva long, about 5 times as long as medially wide; costa abruptly descending ventrally on the basal half; cucullus + harpe without processes or denticles dorsally, almost straight and ended in blunt tip; sacculus broad and with small dentations dorsodistally. Juxta large and its posterior portion extended and ended in an acute tip; the ventromedial portion of juxta broadly swollen through its length. Phallus curved ventrally; ventral sclerotized portion of suprazonal sheath narrow; coecum small, about 1/4 as long as the subzonal sheath and rounded at distal margin; cornuti absent.

Female terminalia: Seventh abdominal segment gently tapering posteriorly; 7th abdominal tergum reduced to about 1/3 of 7th abdominal dorsum; lateral depression large and oval; 7th abdominal sternum trapezoidal with rounded posterodistal portions.

Female genitalia: Eighth abdominal tergum with narrow membranous incision on its anteroventral margin; copulatory cavity broad; ventral portion of copulatory cavity with distinct depression and weakly sclerotized; apophysis anterioris long and about 1.5 times as long as 8th abdominal tergum. Ductus bursae 1/2 as long as corpus bursae. Ductus seminalis short, as long as ductus bursae, slender and strongly bulged near the vagina. Corpus bursae simple and long; cervix bursae well developed and long. Signa absent. Papilla analis sparsely long-haired.

Specimens examined: [Denmark] 1 ♂, Bete, 2. vii. 1968, E. TRAUGOTT-OLSEP leg. (KMNHIR000, 117); [West Germany] 2 ♂♂, Bavaria mer. Steinbach, a. Worthsee, 13. vii. 1949, F. DANIEL leg. (KMNHIR000, 118-119); [Japan] 2 ♂♂, Genseikaen, Hokkaido, 10. vii. 1962, K. IJIMA leg., (ELKU); 1 ♂, Mt. Hikosan, Fukuoka Pref., 14. viii. 1933, T. ESAKI leg. (ELKU); 1 ♀, Mt. Hikosan, Fukuoka Pref., 17. viii. 1933, T. ESAKI leg. (ELKU).

Distribution: Europe, USSR, Korea and Japan.

5-5. *Deltote deceptoria* (SCOPOLI, 1763)
(Figs., 54, 55, 87-E)

Phalaena deceptoria SCOPOLI, 1763, Ent. Carn.: 214.

Lithacodia deceptoria: HAMPSON, 1910, Cat. Lepid. Phalaenae Br. Mus. 10: 535.

Lithacodia deceptoria: KARSHOLT & NIELSEN, 1976, Systematisks fortegnelse over Danmarks sommerfugle: 71.

Length of fore wing: 11–12 mm.

Frons white mixed with dark brown; vertex dull grey; labial palpus dark brown mixed with ochreous; the base of 2nd segment white; antenna dark brown ringed with white. Thorax dark brown mixed with ochreous and rufous; collar dark brown tipped with white; apical portion of tegula and scutellum almost white; pleural area white; legs dark brown mixed with white; tarsi ringed with ochreous white. Abdomen dark brown mixed with white, and with ochreous white segmental rings; dorsal crests on 2nd to 4th segments, and white on 2nd segment, white tipped with black on 3rd and 4th segments.

Fore wing: Dark brown mixed with white and ochreous; subbasal line represented by dark brown striae from costa to discal cell; a dark brown patch, which is suffused with ochreous below costa on subbasal area; subbasal area snowy white; antemedial line white defined by dark brown on outer side, angled outwards below costa, confluent with orbicular stigma on its inner side, then curved inwards; orbicular with incomplete white annulus; claviform reduced to white point; reniform stigma with white annulus, constricted at the middle and open below; postmedial line white, defined by dark brown,

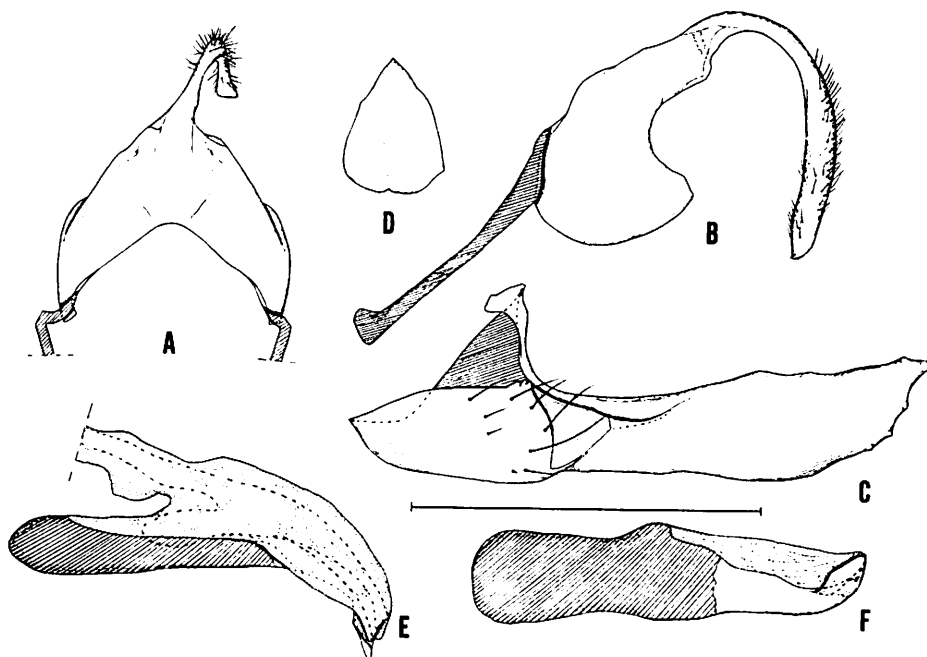


Fig. 54. Male external genitalia of *Deltote deceptoria* (SCOPOLI).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. Scale 1 mm.

curved outwards below costa to vein 7, minutely waved, curved inwards below vein 4, excurved below vein 3 and at vein 1; two white costal spots beyond postmedial line; postmedial area snowy white except for triangular and brown costal patch and dark brown suffusion below vein 4 on the outer side of postmedial area; subterminal line broad, minutely waved from costa, slightly curved inwards below vein 7 and excurved below vein 4; a terminal series of dark brown striae; cilia dark brown mixed with white and reddish brown and chequered with white and dark brown apically.

Hind wing: White irrorated with dark brown; a broad postmedial line white and waved; a dark brown terminal line; cilia dark brown mixed with ochreous white at the base, and white mixed with dark brown scales apically from the apex to vein 2 and at vein 1.

Underside of fore wing: White irrorated with dark brown; costal area tinged with reddish brown; postmedial line defined by a broad ochreous white band on outer side, waved; subterminal line ochreous white and almost straight; a terminal series of dark brown striae; cilia same as the upperside.

Underside of hind wing: White sparsely irrorated with dark brown; a large discoidal spot and waved postmedial line dark brown; the latter defined by broad white band on outer side and expanding into patch at costa; subterminal line broad and dark brown, expanding into patch at costa and reached to termen at vein 1; a dark brown terminal line.

Male external genitalia: Tegumen moderately large and the weakly sclerotized posterior portion of tegumen very narrow; fenestrula well sclerotized, indistinct and

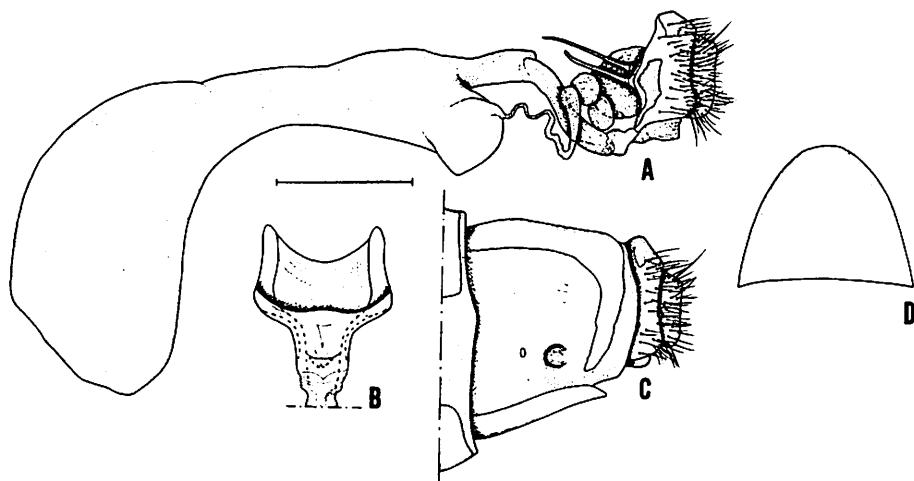


Fig. 55. Female genitalia and terminalia of *Deltote deceptor* (SCOPOLI).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scale 1 mm.

concaved anteriorly; peniculus large, projected posteriorly and ended in truncated distal margin; anterior portion of peniculus rounded; vinculum slender and as deep as tegumen; saccus small. Uncus long, swollen distally, sparsely short-haired, and ended in a blunt tip with a small acute spine. Valva long about 6 times as long as medially wide; costa long, abruptly descending ventrally on the basal half; cucullus + harpe without processes or denticles dorsally, almost straight and ended in a pointed tip; sacculus broad and slightly raised dorsodistally. Juxta moderately large and triangular; the ventromedial portion of juxta concaved basally. Phallus strongly curved ventrally; the ventral sclerotized portion of suprazonal sheath rather broad; coecum small, 1/4 as long as the subzonal sheath and rounded at distal margin; cornuti absent.

Female terminalia: Seventh abdominal segment gently tapering posteriorly; 7th abdominal tergum almost as long as the segment, but largely excavated anterolaterally; lateral depression almost circular; 7th abdominal sternum gently tapering to rounded apex.

Female genitalia: Eighth abdominal tergum with a broad membranous area dorsomedially and with a moderate membranous incision anteroventrally; copulatory cavity well sclerotized and with a small triangular depression on its ventral portion; apophysis anterioris 1.5 times as long as 8th abdominal tergum. Ductus seminalis short, as long as ductus bursae and bulged into moniliform near the vagina. Corpus bursae large and almost hook-shaped. Signa absent. Papilla analis triangular and sparsely long-haired.

Specimens examined: [Denmark] 1 ♂, Knudsskov, 16. vi. 1963, C. AASTROP leg. (KMNHIR000, 120); [West Germany] 1 ♂, Darmstadt, 19. v. 1927, H. NOACK leg. (ELKU); 1 ♂, Darmstadt, 1928, H. NOACK leg. (ELKU); 1 ♀, Darmstadt, 26. v. 1926, H. NOACK leg. (ELKU).

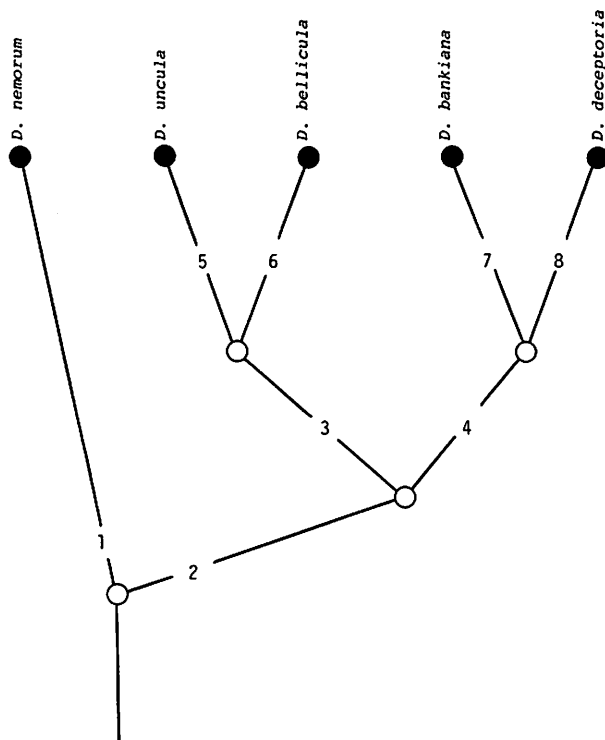
Distribution: Europe, USSR and N. China.

5-6. Phylogenetic relationships in the genus *Deltote*. (Fig. 56).

This genus consists of five species, i. e., *nemorum*, *uncula*, *bellicula*, *bankiana* and *deceptoria*, and is characterized by the following autapomorphies; more or less twisted uncus and membranous incision on the lateral wall of female 8th abdominal tergum. Three monophyletic subgroups; the *nemorum*-, the *uncula*- and the *bankiana*- subgroups are recognized, and the autapomorphies, interspecific relationships of each subgroup and the phylogenetic relationships among the subgroups are discussed as follows.

(1) the *nemorum*-subgroup: This subgroup includes only *nemorum*. It is characterized by an autapomorphy; postmedial area of fore wing white on the inner half and suffused with fuscous brown uniformly (Fig. 56-1).

(2) the *uncula*-subgroup: This subgroup includes *uncula* and *bellicula*. It is characterized by two autapomorphies; a process present on the dorsal margin of cucullus + harpe, and apical portion of uncus bulged (Fig. 56-3). *D. bellicula* is more generalized than



uncula in wing markings, but in the former 7th abdominal sternum very narrow and triangular. On the other hand, a broad brown streak present on the costal area in *uncula* (Fig. 56-5, 6).

(3) the *bankiana*-subgroup: This subgroup includes *bankiana* and *deceptoria*. It is characterized by an autapomorphy; deep triangular depression on ventral wall of copulatory cavity (Fig. 56-4). *D. deceptoria* is more generalized than *bankiana* in wing markings, but in the former, broad and white postmedial line present on the hind wing. *D. bankiana* is specialized in antemedial and postmedial oblique white bands on fore wing.

(4) the phylogenetic relationships of the 3 subgroups: It is inferred that the *uncula*- and the *bankiana*-subgroups form a monophyletic group based on the following synapomorphy: fenestrula more or less sclerotized (Fig. 56–2). This structure is retained in the plesiomorphic state in the *nemorum*-subgroup, and it is inferred that the *nemorum*-subgroup has a sister-group relationship with the monophyletic group including the *uncula*- and the *bankiana*-subgroup.

6. Genus *Sugia** UEDA, 1984

Key to the species

Male

1. Vinculum with a triangular process; ventral margin of cucullus + harpe with acute process beyond the middle 2
- Vinculum without processes; ventral margin of cucullus + harpe without processes 4
2. Dorsal margin of sacculus with a process; cornuti present 3
- Dorsal margin of sacculus without processes; cornuti absent *idiostygia*
3. Triangular process beyond the middle portion of vinculum large; the process from sacculus long and its tip reaching to the dorsal margin of costa *stygia*
- Triangular process beyond the middle portion of vinculum small; the process from sacculus short and its tip not reaching to the dorsal margin of costa ... *elaeostygia*
4. Ventral process from cucullus + harpe long; the apical portion of process from sacculus bent downwards *stygiodes*
- Ventral process from cucullus + harpe short; the apical portion of process from sacculus straight *rufa* sp. nov.

Female

1. Ventral sclerotized portion of copulatory cavity narrow 2
- Ventral sclerotized portion of copulatory cavity broad and dilating posteriorly 3
2. Seventh abdominal segment short, about 1.5 times as long as 6th abdominal segment; 7th abdominal sternum almost oblong with slightly concaved distal margin *stygia*
- Seventh abdominal segment long, about 3.0 times as long as 6th abdominal segment; 7th abdominal sternum long, gradually tapering to rounded distal margin *idiostygia*
3. Seventh abdominal tergum short, about 1.5 times as long as 6th abdominal tergum; corpus bursae rounded *elaeostygia*
- Seventh abdominal tergum long, about 2.5 times as long as 6th abdominal tergum; corpus oblong *stygiodes*

6-1. *Sugia idiostygia* (SUGI, 1958)

(Figs., 22, 23, 28–H)

Jaspidia idiostygia SUGI, 1958, *Tinea* 4 (1): 224, figs. 3, 4.*Jaspidia idiostygia*: INOUE & SUGI, 1958, Check List of the Lepid. Japan 5: 544.*Lithacodia idiostygia*: SUGI, 1982, In INOUE, H. et al., Moths of Japan 1: 817, 2: 383, pl. 197: 48–50.

* This generic name was dedicated to Mr. Shigero SUGI, Tokyo who has always encouraged me during this study.

Length of fore wing: 10–13 mm.

Frons fuscous mixed with ochreous; vertex more whitish; labial palpus dark brown mixed with ochreous and tipped with ochreous on 2nd and 3rd segments; antenna dark brown ringed with pale ochreous. Thorax fuscous mixed with white and ochreous, sometimes tinged with golden brown; pleural area whitish; legs dark brown mixed with ochreous; tarsi banded with ochreous; mid and hind legs more whitish. Abdomen fuscous mixed with ochreous and with indistinct ochreous segmental lines; ventral portion of abdomen more whitish; dorsal crests on 2nd to 4th segments, dark brown and tipped with white.

Fore wing: Fuscous; the costal area tinged with rufous; subbasal line dark brown, indistinct, slightly defined by ochreous on each side and waved from costa to discal cell; antemedial line white, indistinct, slightly defined by dark brown on outer side and sinuous; orbicular with elliptical white annulus; a dark brown median shade between orbicular and reniform; claviform usually absent, sometimes represented by very small white spot, defined by dark brown on outer side; a dark brown submedian streak; reniform with white annulus, defined by dark brown at extremities, constricted at the middle and open below; postmedial line white irregularly defined on each side by dark brown, angled outwards to vein 7, minutely waved to vein 5, curved inwards to vein 3 and sinuous towards inner margin; three ochreous costal spots beyond postmedial line; postmedial area suffused with ochreous and rufous below vein 4; apical patch dark brown and indistinct; subterminal line white, sinuous and excurved below vein 7 and vein 4; subterminal area irrorated with white; terminal series of lunules dark brown and slightly defined by white on inner side; cilia fuscous with indistinct ochreous lines at the base and the middle through them.

Hind wing: Fuscous brown; indistinct brown terminal line; cilia fuscous with ochreous lines at the base and the middle through them.

Underside of fore wing: White mixed with dark brown; costal area tinged with ochreous and rufous; dark brown terminal series of small lunules; cilia fuscous and ochreous at the base.

Underside of hind wing: White irrorated with dark brown; costal area tinged with ochreous; dark brown discoidal spot and waved postmedial line; dark brown terminal line; cilia more whitish.

Male external genitalia: Tegumen long and slender; fenestrula untraceable; peniculus not developed; vinculum narrow and moderately short, 1/3 as deep as tegumen; a small triangular plate on the vinculum at the apical 1/3; saccus large and truncated. Uncus slender, rather short, long-haired, gently curved dorsally and ended in an acute tip. Valva very long, about 10 times as long as medially wide; costa narrow, gently descending distally; cucullus + harpe slender, strongly curved dorsally, abruptly narrowing on its apical portion and ended in a pointed tip; sacculus large, without processes dorsally. Juxta large, almost oblong and swollen ventromedially. Phallus long; the sclerotized portion of suprazonal sheath moderately broad and curved ventrally on the apical portion;

coecum long, 1/2 as long as subzonal sheath and strongly curved dorsally; cornuti absent.

Female terminalia: Seventh abdominal segment long, 3 times as long as 6th abdominal segment; 7th abdominal sternum tapering to rounded distal margin.

Female genitalia: Eighth abdominal tergum weakly sclerotized and membranized dorsally; apophysis anterioris slender and as long as 8th abdominal tergum; copulatory cavity deep, 2 times as deep as 8th abdominal tergum and with narrow sclerotized portion ventrally. Ductus bursae long, almost as long as corpus bursae and projected dorsally. Ductus seminalis about 1.5 times as long as ductus bursae and bulged beyond the middle. Corpus bursae short; cervix bursae small. Signa absent. Papilla analis narrow, weakly sclerotized and sparsely haired; apophysis posterioris shorter than apophysis anterioris.

Specimens examined: [Japan] 1 ♂, Nika, Maki, Niigata Pref., 10. vi. 1970, R. SATO leg. (KMNHIR000, 121); 1 ♂, Tsutsu, Tsushima Is., Nagasaki Pref., 26. v. 1930, T. ESAKI and FUJINO leg. (ELKU); 1 ♂, Chōyō, Kumamoto Pref., 1. vi. 1976, K. ŌHARA leg. (KMNHIR000, 122); 2 ♀ ♀, Mt. Wakasugi, Fukuoka Pref., 14. vii. 1974, bred by K. UEDA. (KMNHIR000, 123–124); 1 ♀, Kureko, Kumamoto Pref., 3. vi. 1976, K. ŌHARA leg. (KMNHIR000, 125).

Distribution: Japan.

6-2. *Sugia stygia* (BUTLER, 1878)

(Figs., 57, 58, 87–F)

Erastria stygia BUTLER, 1878, *Ann. Mag. nat. Hist.* (5) 1: 199.

Erastria fasciana: LEECH, 1889 (nec LINNAEUS, 1761), *Proc. Zool. Soc. Lond.* 1889: 526 (part).

Lithacodia stygia: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 540.

Jaspidia stygia: INOUE & SUGI, 1958, *Check List of the Lepid. Japan* 5: 544.

Lithacodia stygia: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 817, 2: 383, pl. 197: 46–47.

Length of fore wing: 10–13 mm.

Head dark brown mixed with white and ochreous; labial palpus dark brown mixed with white; antenna dark brown ringed with white. Thorax dark brown mixed with white, ochreous and rufous; collar distinctly tipped with white; pleural area whitish; legs dark brown mixed with ochreous; tarsi ringed with ochreous. Abdomen dark brown with white segmental lines; ventral portion of abdomen whitish; caudal portion of abdomen fuscous with ochreous tufts in male; dorsal crests dark brown on 3rd to 5th segments.

Fore wing: Dark brown with some rufous, white and ochreous; subbasal line dark brown, defined by white on outer side and excurved to vein 1; antemedial line white, irregularly defined by dark brown on outer side and minutely waved; orbicular with slender white annulus; claviform absent; medial area more or less uniformly covered with dark brown scales and median shade indistinct; reniform with white annulus, open below and constricted at middle; sometimes the middle portion of this annulus filled with white suffusion, then reniform forming 8 figure-shaped mark; postmedial line white, defined by

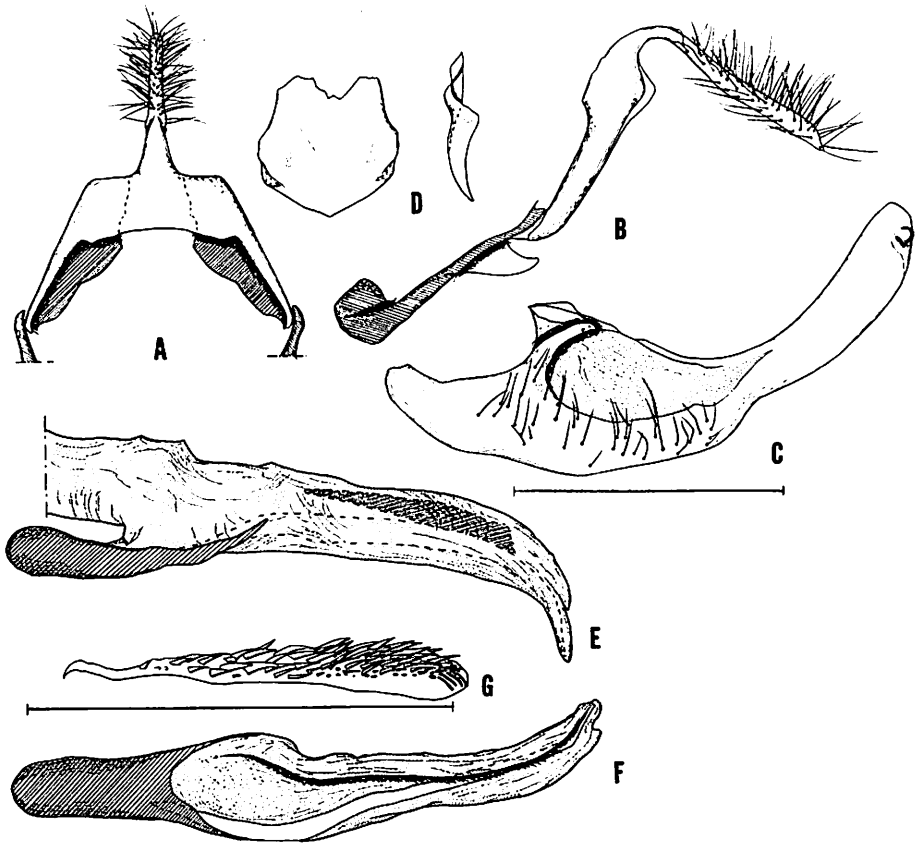


Fig. 57. Male external genitalia of *Sugia stygia* (BUTLER).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. G: Cornuti. Scales 1 mm.

dark brown on inner side, angled outwards from costa to vein 7, indistinct to vein 4, curved inwards below vein 4 and excurved below vein 2; three white costal spots beyond the postmedial line; postmedial area below vein 4 suffused with ochreous; subterminal line white, indistinct and wavy; subterminal area suffused with white and ochreous between veins 7 and 5, and below vein 3; terminal series of black lunules; cilia fuscous at the base, and chequered with fuscous and white apically.

Underside of fore wing: Fuscous brown; costal area slightly tinged with ochreous; terminal line dark brown and interrupted at veins and obsolete towards tornus.

Underside of hind wing: White mixed with fuscous brown and ochreous; a dark brown discoidal spot moderately large; postmedial line minutely wavy; postmedial area suffused with ochreous and fuscous brown; indistinct dark brown terminal line.

Male external genitalia: Tegumen broad and well sclerotized; fenestrula untraceable;

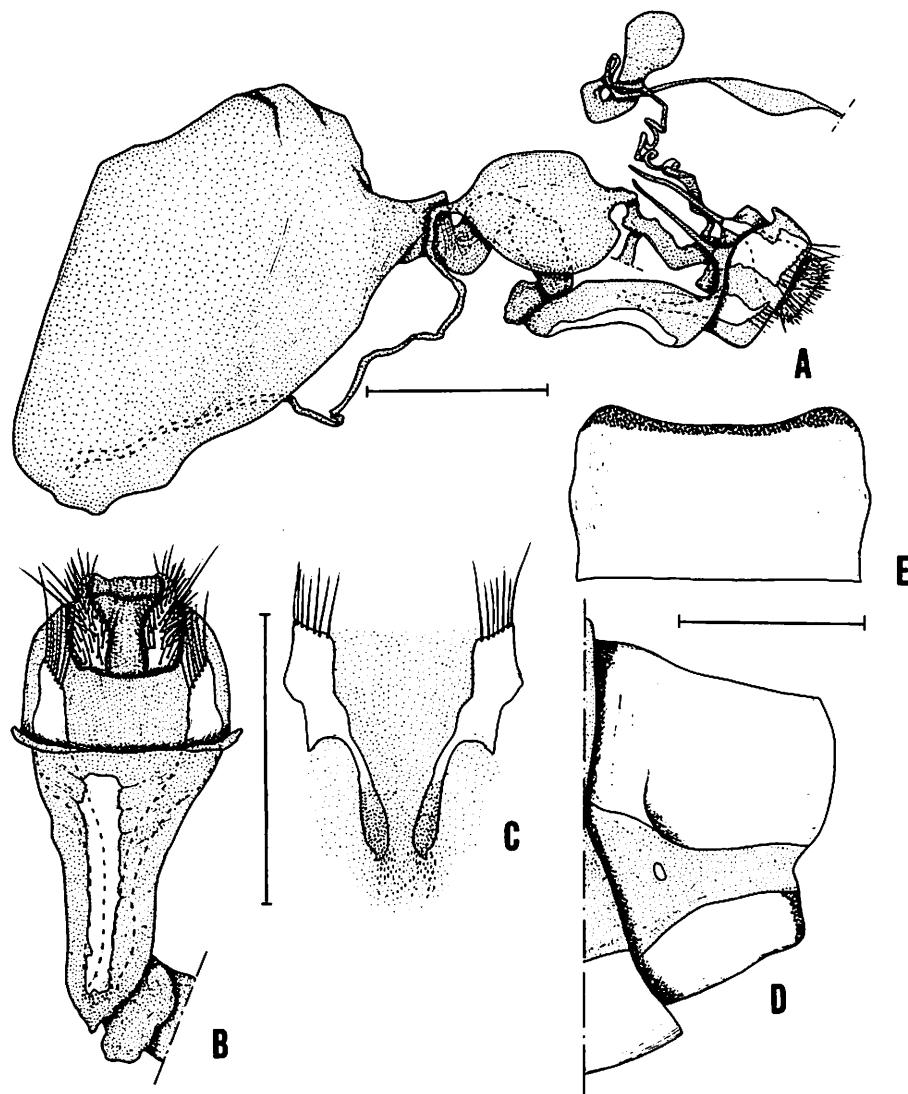


Fig. 58. Female genitalia and terminalia of *Sugia stygia* (BUTLER).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Dorsal wall of ostium in ventral view. D: Female terminalia in lateral view (left). E: Seventh abdominal sternum in ventral view. Scales 1 mm.

peniculus not developed; vinculum short, $1/2$ as deep as tegumen and with a large triangular process beyond the middle; saccus large and truncated. Uncus almost as long as tegumen, slightly curved dorsally, weakly sclerotized, club-shaped and long-haired. Valva long, 6 times as long as medially wide; costa narrow, gently descending distally;

cucullus + harpe well sclerotized, strongly curved dorsally and with an acute process ventrodistally; sacculus large, with a long dorsal process at the middle, the tip of which reaches to the dorsal margin of costa. Juxta large, almost flat and irregularly dentated at the distal margin. Phallus long; the sclerotized portion of suprazonal sheath very narrow and strongly curved ventrally on its apical portion; coecum rather short, $1/3$ as long as subzonal sheath; cornuti represented by a large sclerotized plate with long serrations, which is pointed apically.

Female terminalia: Seventh abdominal segment short, 1.5 times as long as 6th abdominal segment; anteroventral margin of 7th abdominal tergum weakly sclerotized and with a rounded, concaved area; 7th abdominal sternum almost oblong with slightly concaved distal margin.

Female genitalia: Eighth abdominal tergum weakly sclerotized and broadly membranized dorsally; apophysis anterioris 2 times as long as 8th abdominal tergum; the ventral sclerotized portion of copulatory cavity long, almost as long as copulatory cavity and narrow. Ductus bursae rather short, $2/3$ as long as corpus bursae and projected dorsally. Ductus seminalis long, 2.5 times as long as ductus bursae and bulged near the vagina. Corpus bursae stout; cervix bursae very small. Signa absent. Papilla analis narrow, weakly sclerotized and short-haired; apophysis posterioris as long as apophysis anterioris.

Specimens examined: [Japan] 1 ♂, Ozino, Gifu Pref., 16. vi. 1976, H. ENDO leg. (KMNHIR000, 126); 1 ♂, Mt. Hikosan, Fukuoka Pref., 16. viii. 1933, T. ESAKI leg. (ELKU); 1 ♂, Chōjabaru, Mt. Kuju, Ōita Pref., 7. vi. 1978, K. SETOYA leg. (KMNHIR 000, 127); 1 ♂, Naze, Amami Is., Kagoshima Pref., 20. iv. 1974, H. MAKIHARA leg. (KMNHIR000, 128); 1 ♀, Awa Is., Niigata Pref., 27. viii. 1968, R. SATO leg. (KMNHIR 000, 129); 1 ♀, Ukenokuchi, Ōita Pref., 13. viii. 1974, Y. YOSHIYASU leg. (KMNHIR000, 130).

Distribution: China, Korea and Japan.

6-3. *Sugia elaeostygia* (SUGI, 1982)
(Figs., 59, 60, 87-G)

Lithacodia elaeostygia SUGI, 1982, In INOUE, H. et al., Moths of Japan 1: 817, 2: 383, pl. 197: 51-52.

Length of fore wing: 10-12 mm.

Frons ochreous mixed with pale brown; vertex almost ochreous; labial palpus brown; the base of 2nd segment ochreous and tipped with ochreous on 2nd and 3rd segments; antenna brown slightly ringed with pale ochreous. Thorax brown mixed with white and ochreous; pleural area white; fore leg ochreous slightly mixed with pale brown; fore tarsus brown banded with ochreous; mid and hind legs ochreous. Abdomen pale brown mixed with ochreous and with white segmental rings; ventral portion of abdomen more whitish; dorsal crests on 3rd to 5th segments, brown and tipped with white.

Fore wing: Pale brown mixed with ochreous; costal area slightly tinged with rufous;

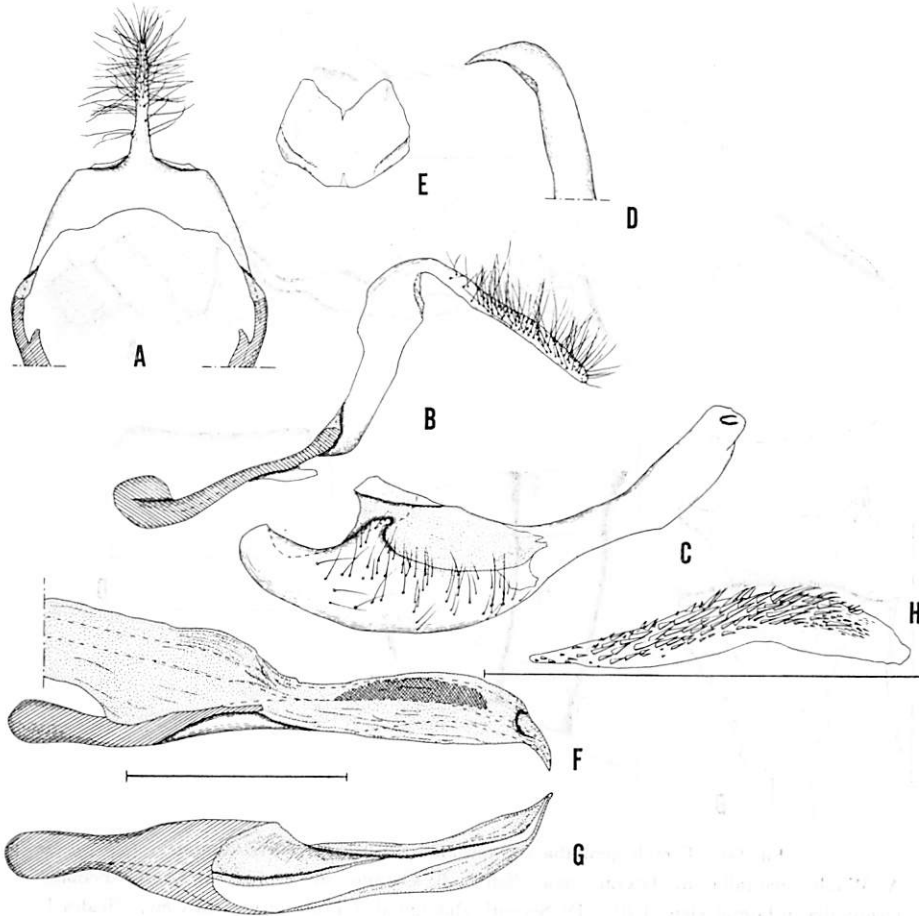


Fig. 59. Male external genitalia of *Sugia elaeostygia* (SUGI).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view.
D: Apical portion of left valva in dorsal view. E: Juxta. F: Phallus in lateral view (left).
G: Phallus in ventral view. H: Cornuti. Scales 1 mm.

subbasal line pale brown, excurved below costa and interrupted in the discal cell; antemedial line white, defined by brown on outer side and wavy; orbicular with white annulus, indistinct and sometimes reduced to small white lunule; claviform absent; median and submedian shades indistinct; reniform with white annulus and constricted at the middle; sometimes reniform open below; postmedial line white, defined by brown on inner side, angled outwards below costa to vein 7, then moderately wavy, curved inwards below vein 3, and sinuous to inner margin; three ochreous costal spots beyond the postmedial line and large; postmedial area suffused with ochreous, except for costal region and the area below vein 3, which are more whitish; subterminal area suffused with ochreous; subterminal line white, excurved below veins 7 and 4; terminal series of brown

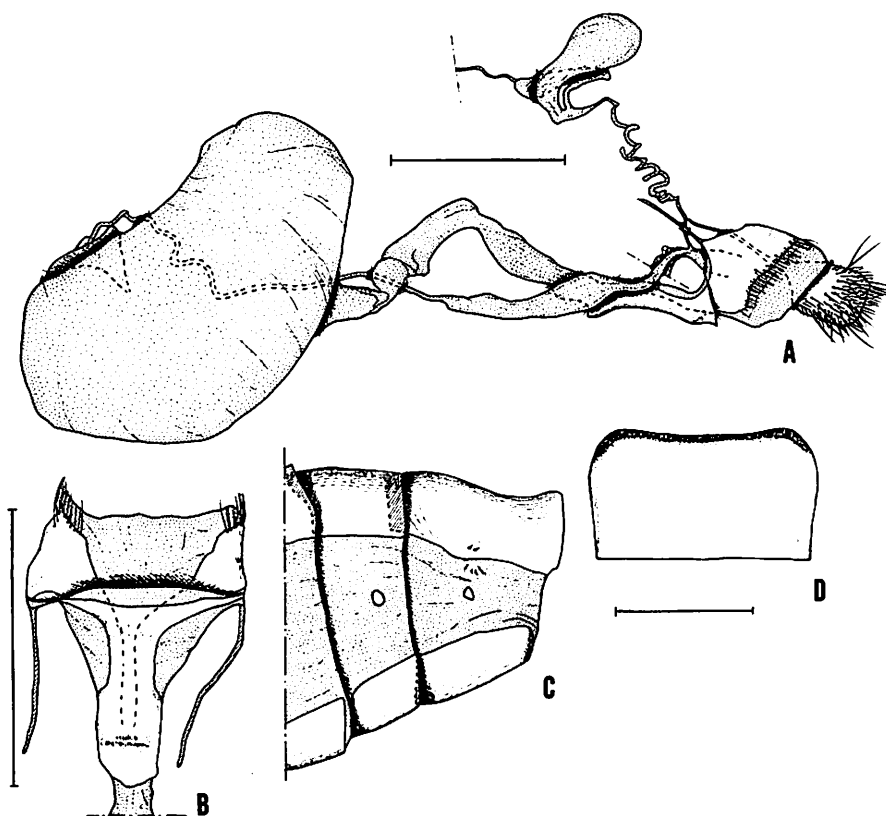


Fig. 60. Female genitalia and terminalia of *Sugia elaeostygia* (SUGI).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scales 1 mm.

striae obsolete towards tornus; cilia brown, chequered with brown and white apically.

Hind wing: White, irrorated with brown; terminal line brown; cilia pale brown basally with an ochreous line through them and chequered with brown and white apically.

Underside of fore wing: White irrorated with brown; costal and subterminal areas tinged ochreous; terminal series of brown striae; cilia same as upperside.

Underside of hind wing: White, sparsely mixed with brown; small discoidal spot and waved postmedial line brown; postmedial area sometimes tinged with rufous; a faint brown terminal line; cilia almost white, a pale brown line through them at the middle and chequered with and fuscous apically.

Male external genitalia: Tegumen broad and well sclerotized; fenestrula untraceable; peniculus not developed; vinculum short, $1/2$ as deep as tegumen and with a small triangular process beyond the middle; saccus large and rounded. Uncus almost as long

as tegumen, straight, weakly sclerotized, club-shaped and densely long-haired. Valva long, 6 times as long as medially wide; costa narrow, gently descending distally; cucullus + harpe well sclerotized, strongly curved dorsally and with an acute process ventrodistally; sacculus large, with a short process at the middle, the tip of which does not reach to the dorsal margin of costa. Juxta large, almost flat and deeply concaved at the distal margin. Phallus long; the sclerotized portion of suprazonal sheath rather broad and curved ventrally on its apical portion; coecum rather short $1/3$ as long as subzonal sheath; cornuti represented by a large sclerotized plate with long serrations, which is tapering towards its blunt anterior tip.

Female terminalia: Seventh abdominal tergum about 1.5 times as long as 6th abdominal tergum; ventrolateral margin of 7th abdominal tergum swollen at the middle.

Female genitalia: Eighth abdominal tergum weakly sclerotized and broad; apophysis anterioris slender and as long as 8th abdominal tergum; copulatory cavity large and deep; ventral sclerotized portion of copulatory cavity long, rather narrow and dilating towards its posterior margin. Ductus bursae long, as long as corpus bursae. Ductus seminalis long, 2 times as long as ductus bursae and slightly bulged near the vagina. Corpus bursae moderately small; cervix bursae small. Signa absent. Papilla analis weakly sclerotized, almost quadrate and long-haired; apophysis posterioris slender, 1.5 times as long as apophysis anterioris.

Specimens examined: [Japan] 1 ♂, Jōkō-ji, Aichi Pref., 25. v. 1968, B. TANAKA leg. (KMNHIR000, 131); 1 ♂ 1 ♀, Jōkō-ji, Aichi Pref., 11. viii. 1968, B. TANAKA leg. (KMNHIR000, 132-133); 1 ♂, Dankei-St., Nagoya City, Aichi Pref., 16. viii. 1968, B. TANAKA leg. (KMNHIR000, 134); 1 ♂, Mt. Hikosan, Fukuoka Pref., 9. viii. 1957, H. KUROKO leg. (ELKU); 1 ♂, Chōjabaru, Mt. Kuju, Ōita Pref., 6. vi. 1978, K. SETOYA leg. (KMNHIR000, 135); 1 ♂ 1 ♀, Kikuchi, Kumamoto Pref., 31. vii. 1975, Y. YOSHIYASU et al. leg. (KMNHIR000, 136-137); 1 ♀, Yuno-yama, Mie Pref., 19. vi. 1966, B. TANAKA leg. (KMNHIR000, 138); 1 ♀, Mt. Sarakurayama, Fukuoka Pref., 19. viii. 1960, T. KAWAMURA leg. (KMNHIR000, 139); 1 ♀, Mt. Hikosan, Fukuoka Pref., 18. vi. 1962, T. KAWAMURA leg. (KMNHIR000, 140).

Distribution: Japan.

6-4. *Sugia rufa* sp. nov.

(Figs., 61, 87-H)

Length of fore wing: 13 mm.

Frons brown mixed with white and rufous; vertex more ochreous; labial palpus dark brown, slightly tipped with white on 2nd and 3rd segments; antenna dark brown with faint white rings. Thorax dark brown mixed with white, and tinged with rufous; collar dark brown tinged with white; a white transverse dorsal line on the middle; pleural area white. Fore leg dark brown mixed with ochreous; fore tarsus banded with ochreous; mid and hind legs more whitish. Abdomen fuscous mixed with white, and with white

segmental lines; dorsal crests on 2nd to 4th segments, dark brown tipped with white.

Fore wing: Dark brown tinged with rufous; subbasal line dark brown, excurved below costa and interrupted on the discal cell; antemedial line white, defined by dark brown on each side and minutely waved; orbicular with white annulus, defined by dark

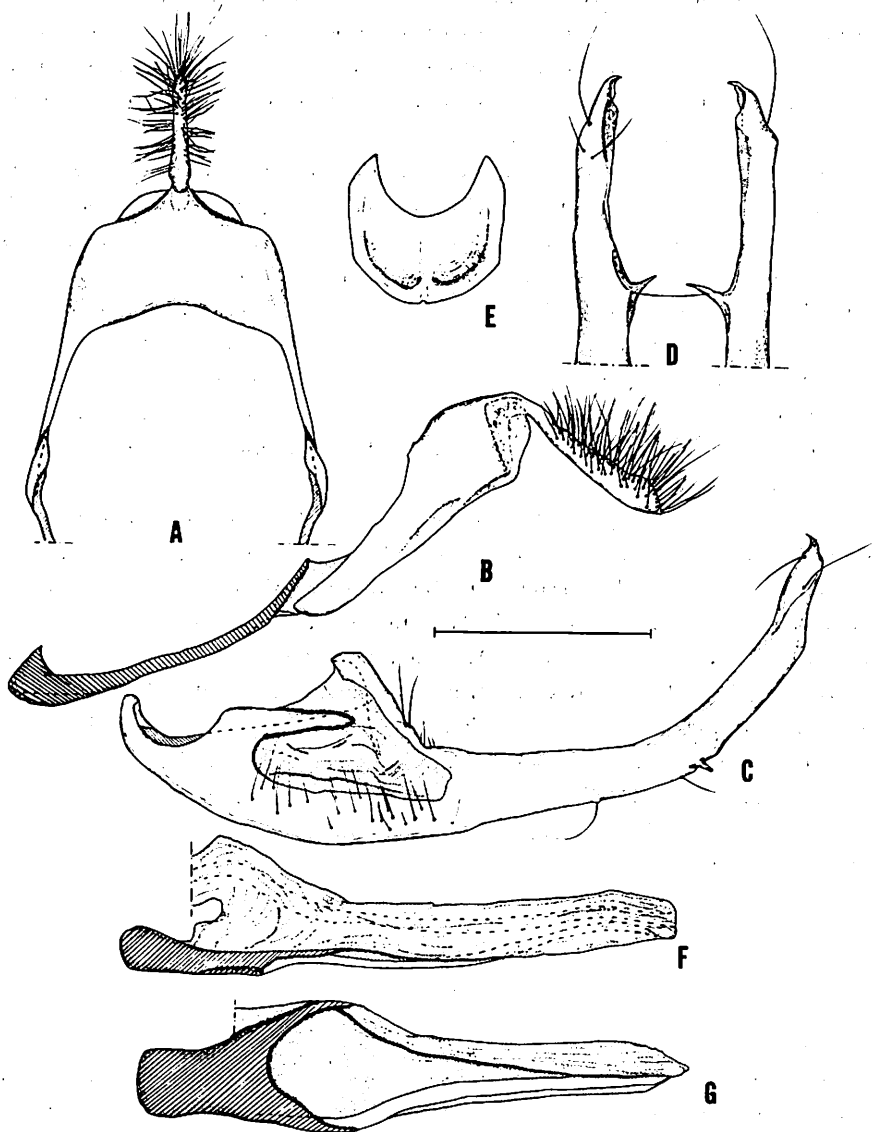


Fig. 61. Male external genitalia of *Sugia rufa* sp. nov.

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Apical portion of valvae in ventral view. E: Juxta. F: Phallus in lateral view (left). G: Phallus in ventral view. Scale 1 mm.

brown at extremities; median shade dark brown; reniform with white annulus, defined dark brown and constricted at the middle; medial line dark brown, oblique and sinuous from the lower angle of cell to inner margin; postmedial line white defined by dark brown on each side, excurved below costa to vein 7, then indistinct to vein 4, curved inwards to vein 2 and sinuous to inner margin; three ochreous costal spots beyond postmedial line; postmedial area rufous below costa and suffused with ochreous below vein 3; subterminal line white, indistinct, excurved below vein 7 and at the middle; subterminal area suffused with rufous and with a wedge-shaped streak below vein 4; a terminal series of dark brown striae; cilia brown, suffused with white near tornus with an ochreous line at the middle through them, and chequered with ochreous and brown apically.

Hind wing: White irrorated with dark brown; a dark brown terminal line; cilia brown with an ochreous line basally and chequered with brown and ochreous apically.

Underside of fore wing: White irrorated with brown; costal area tinged with rufous and ochreous; a faint terminal series of dark brown striae.

Underside of hind wing: White mixed with dark brown; costal area tinged with rufous at the middle; a discoidal spot and minutely waved postmedial line brown; postmedial area suffused with brown; terminal series of dark brown striae; cilia more whitish.

Male external genitalia: Tegumen broad and long; dorsodistal portion of tegumen concaved; fenestrula untraceable; peniculus not developed; vinculum slender and long, $2/3$ as deep as tegumen; no processes on the middle portion of vinculum; saccus small, projecting dorsally and ended in pointed tip. Uncus short, long-haired, rather broad, gradually dilating and ended in an acute tip. Valva very long, about 10 times as long as medially wide; costa moderately broad, strongly descending distally; cucullus + harpe strongly curved dorsally, with a slender, acute and short process ventrally beyond the middle; these processes of both valvae not overlapped each other in normal position; sacculus large and shallow with a large process dorsally, which is bent at the basal $1/3$, then projecting straight and tapering towards its acute tip. Juxta large, longitudinally raised medially and strongly excavated on its distal margin. Phallus very long; sclerotized portion of suprazonal sheath very slender and straight; coecum short, $1/4$ as long as subzonal sheath; cornuti absent.

Female: Unknown.

Holotype ♂, (Type No. 2587, Kyushu Univ.), Taroko, (Karenkō-chō), Batakan, 29. vii. 1932, T. ESAKI leg. (ELKU).

Distribution: Taiwan.

6-5. *Sugia stygiodes* (SUGI, 1958)
(Figs., 62, 63, 88-A)

Jaspidia stygiodes SUGI, 1958, *Tinea* 4 (1); 223, figs., 1, 2, 9.

Jaspidia stygiodes: INOUE & SUGI, 1958, Check List of the Lepid. Japan 5: 544.

Lithacodia stygiodes: SUGI, 1982, In INOUE, H. et al., Moths of Japan 1: 817, 2: 383, pl. 197: 43-45.

Length of fore wing: 10–13 mm.

Frons white mixed with dark brown and fuscous; vertex fuscous mixed with white; labial palpus dark brown mixed with white and slightly tipped with white on the 2nd and

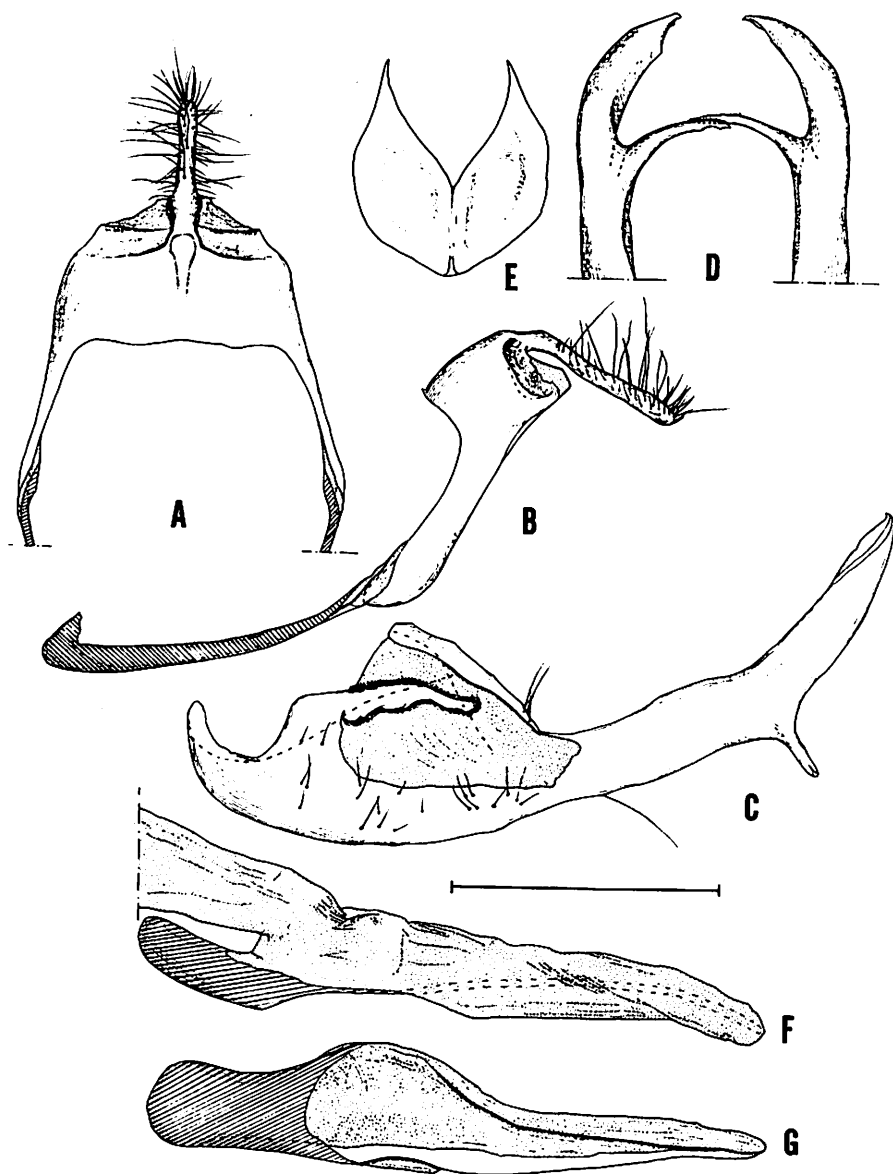


Fig. 62. Male external genitalia of *Sugia stygiodes* (SUGI).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Apical portion of valvae in ventral view. E: Juxta. F: Phallus in lateral view (left). G: Phallus in ventral view. Scale 1 mm.

3rd segments; antenna dark brown ringed with white. Thorax dark brown mixed with white and rufous; tegula with a white patch on the middle; pleural area white. Fore leg dark brown irrorated with white and rufous; fore tarsus banded with ochreous; mid and hind legs more whitish. Abdomen fuscous mixed with white and ochreous, with indistinct ochreous segmental lines, and whitish ventrally; dorsal crests dark brown, slightly whitish at the base and on 3rd to 5th segments.

Fore wing: Dark brown suffused with rufous except for the medial area; subbasal line indistinct, represented by dark brown spots in discal cell, antemedial line ochreous, irregularly defined by dark brown on each side, minutely waved from costa to vein 1, then excurved; orbicular with white annulus, sometimes indistinct; claviform untraceable; a dark brown median shade between orbicular and reniform; submedian area uniformly dark brown; reniform with white annulus and constricted at the middle; postmedial line white, angled outwards below costa to vein 7, untraceable to vein 3, then represented by rather white band, which is defined by dark brown on outer side, and sinuous to inner

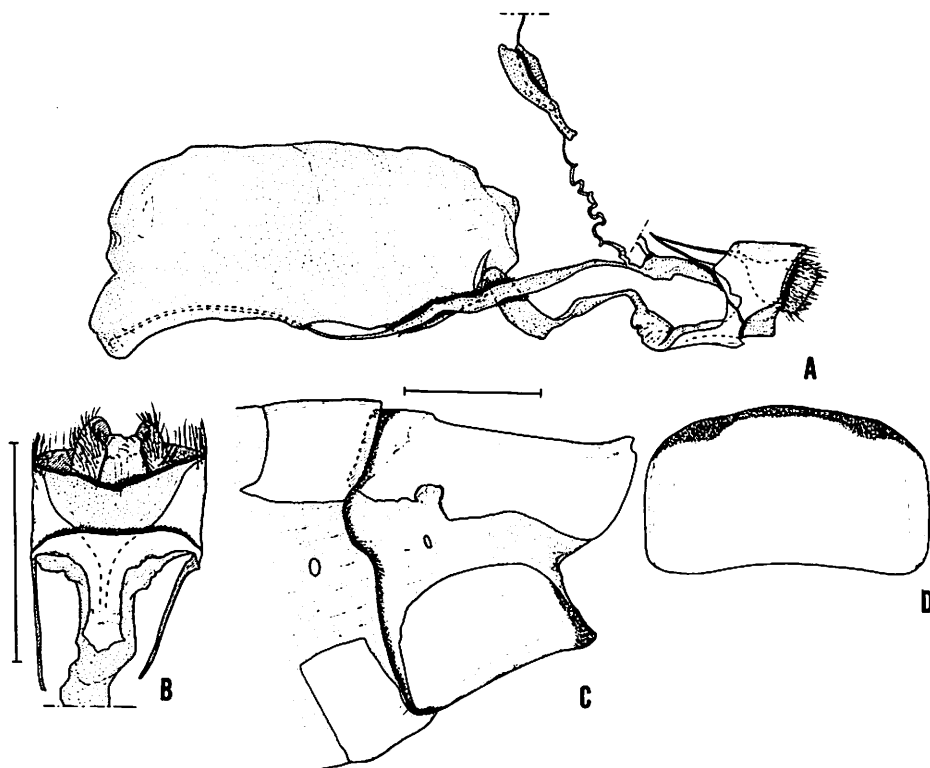


Fig. 63. Female genitalia and terminalia of *Sugia stygiodes* (Suoi). A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scales 1 mm.

margin; three ochreous costal spots beyond postmedial line; postmedial area below vein 4 suffused with white and ochreous; a dark brown apical patch indistinct; subterminal line white indistinct, excurved below veins 7 and 5; subterminal area suffused with rufous and white; terminal series of dark brown lunules; cilia fuscous, chequered with white and fuscous apically.

Hind wing: Fuscous brown; terminal line fuscous; cilia fuscous, basally with an ochreous line through them, and chequered with white and fuscous apically.

Underside of fore wing: White irrorated with pale brown; costal area tinged with ochreous and rufous; terminal line dark brown.

Underside of hind wing: White mixed with dark brown and rufous; costal area and postmedial area suffused with rufous; discoidal spot and waved postmedial line dark brown; a dark brown terminal line; cilia more whitish.

Male external genitalia: Tegumen broad and long; dorsodistal portion of tegumen concaved; fenestrula untraceable; peniculus not developed; vinculum slender and long, about 1/4 as deep as tegumen; no processes on the middle portion of vinculum; saccus small, projecting dorsally and ended in pointed tip. Uncus short, narrow and sparsely long-haired. Valva very long, about 10 times as long as medially wide; costa moderately broad, strongly descending distally; cucullus + harpe strongly curved dorsally, with a slender, acute and long process ventrally at the middle; these processes of both valvae overlapped each other in normal position; sacculus large and shallow with a large dorsally, which is bent at the basal 1/3, then projecting almost straight and curved ventrally near its tip. Juxta large, longitudinally raised medially and with its arms tapering dorsally towards acute tips. Phallus very long; sclerotized portion of suprazonal sheath very slender and straight; coecum 1/2 as long as subzonal sheath; cornuti absent.

Female terminalia: Seventh abdominal tergum long, about 2.5 times as long as 6th abdominal tergum; ventrolateral margin of 7th abdominal tergum irregularly desclerotized anteriorly.

Female genitalia: Eighth abdominal tergum weakly sclerotized with a narrow membranous incision anteroventrally; apophysis anterioris slender, as long as 8th abdominal segment; copulatory cavity broad and deep; ventral sclerotized portion of copulatory cavity broad and strongly dilating towards its posterior margin. Ductus bursae 1/2 as long as corpus bursae. Ductus seminalis long, 2.5 times as long as ductus bursae and slender. Corpus bursae large and oblong; cervix bursae very short. Signa absent. Papilla analis weakly sclerotized and densely short-haired; apophysis posterioris as long as apophysis anterioris.

Specimens examined: [Taiwan] 1 ♂, Hotso, Nanto Hsien, 26–29, vi. 1978, M. OWADA leg. (KMNHIR000, 141); [Japan] 2 ♂♂, Mt. Akiba, Niigata Pref., 4. viii. 1959, R. SATO leg. (KMNHIR000, 142–143); 5 ♂♂, Mt. Akiba, Niigata Pref., 10. vi. 1960, R. SATO leg. (KMNHIR000, 144–148); 1 ♂, Jōkō-ji, Aichi Pref., 25. v. 1968, B. TANAKA leg. (KMNHIR000, 149); 1 ♂, Mt. Hikosan, Fukuoka Pref., 7. viii. 1958, H. KUROKO leg. (ELKU); 1 ♀, Odaru, Shizuoka Pref., 26. vii. 1959, S. SUGI leg. (SUGI Collection).

Distribution: Taiwan and Japan.

6-6. Phylogenetic relationships in the genus *Sugia* (Fig. 64).

This genus consists of five species, i. e., *idiostygia*, *stygia*, *elaeostygia*, *rufa* and *stygiodes*. The genus *Sugia* is characterized by the following autapomorphies; muscle 8 of male external genitalia divided into two parts, fenestrula completely fused with the adjacent sclerites, sclerotized portion of suprazonal sheath very narrow and the uncus weakly sclerotized and short. Three monophyletic subgroups: the *idiostygia*-, the *stygia*- and the *stygiodes*-subgroups are recognized. The autapomorphies and interspecific relationships of each subgroup and the phylogenetic relationships among the subgroups are discussed as follows.

(1) the *idiostygia*-subgroup: This subgroup includes only *idiostygia*. It is characterized by two autapomorphies; the dorsal margin of uncus curved dorsally, and the female 7th abdominal segment very long, almost 3 times as long as 6th abdominal segment (Fig. 1 64-3).

(2) the *stygia*-subgroup: This subgroup consists of *stygia* and *elaeostygia*. It is characterized by two autapomorphies; a short acute process present on the apical margin

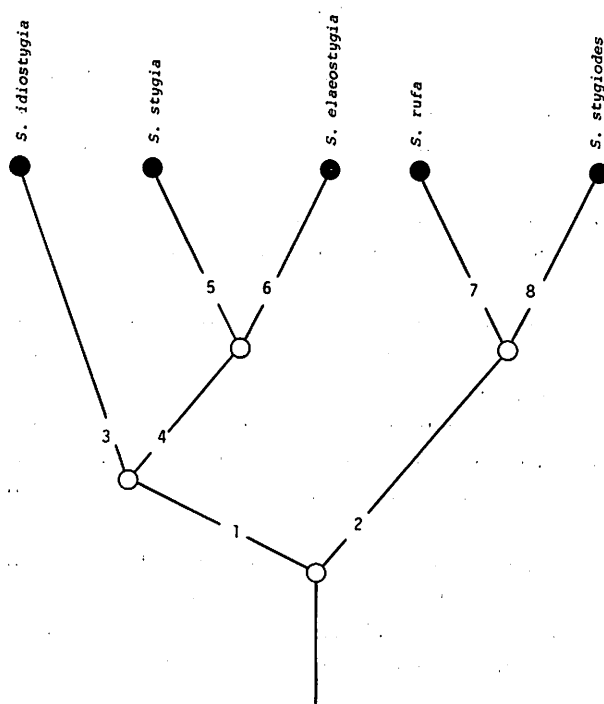


Fig. 64. Inferred phylogenetic relationships in the genus *Sugia*.

of cucullus + harpe, and cornuti is present (Fig. 64-4). *S. stygia* is more generalized than *elaeostygia* in wing markings, but in the former slender process from the sacculus is elongated. On the other hand, postmedial and subterminal areas are suffused with ochreous in *elaeostygia* (Fig. 64-5, 6).

(3) the *stygiodes*-subgroup: This subgroup consists of *stygiodes* and *rufa*. It is characterized by an autapomorphy; acute process present on ventral margin of cucullus + harpe (Fig. 64-2). This process is developed and more specialized in *stygiodes*. The autapomorphy of *rufa* is uncertain at the present.

(4) the phylogenetic relationships of the 3 subgroups: It is inferred that *idiostygia*- and the *stygia*-subgroups form a monophyletic group based on the following synapomorphy: a triangular process present on the middle portion of vinculum. This structure is retained in the plesiomorphic state in the *stygiodes*-subgroup and it is inferred that the *stygiodes*-subgroup has a sister-group relationship with a monophyletic group including the *idiostygia*- and the *stygia*-subgroups.

7. Genus *Neustrotia* SUGI, 1982

Key to the species

Male

1. The apical process of cornuti long, almost as long as subzonal sheath..... 2
 - The apical process of cornuti short 4
2. Harpe short 3
 - Harpe long, almost as long as cucullus and ended in acute tip..... *sugii*
3. Dorsal margin of cucullus gently descending distally; sacculus concaved at the middle of dorsal margin, and without dentations *japonica*
 - Dorsal margin of cucullus strongly swollen dorsally; sacculus with small dentations on its dorsobasal margin *costimacula*
4. Harpe broad and bifurcated at the apex; cucullus with an acute process ventrodistally; hair pencils absent *noloides*
 - Harpe slender and not bifurcated at the apex; cucullus without ventrodistal process; hair pencils present between the saccus and the 8th abdominal sternum *rectilineata* sp. nov.

Female

1. Ventromedial portion of 8th abdominal segment well sclerotized 2
 - Ventromedial portion of 8th abdominal segment membranous 3
2. Posterior margin of 7th abdominal sternum almost straight *rectilineata* sp. nov.
 - Posterior margin of 7th abdominal sternum excavated at the middle *sugii*
3. Ductus bursae rather long, as long as corpus bursae; signa represented by small irregular-shaped plate *japonica*

- Ductus bursae short, 1/3 as long as corpus bursae; signa represented by small triangular plate and many minute spines..... *noloides*

7-1. *Neustrotia japonica* (WARREN, 1912)
(Figs., 24, 25, 29-B)

Eustrotia costimacula japonica WARREN, 1912, in Seitz, Gross-Schmett. Erde 3: 281, t. 52f.

Neustrotia japonica: SUGI, 1982, In INOUE, H. et al., Moths of Japan 1: 819, 2: 384, pl. 197: 61.

Length of fore wing: 9–11 mm.

Frons and vertex brown mixed with white; labial palpus brown slightly mixed with ochreous; antenna brown ringed with white. Thorax pale brown at the base and white; collar pale brown; tegula pale brown at the base and white from the basal 1/3 towards apex; pleural area white. Fore leg fuscous brown mixed with ochreous; fore tarsus fuscous brown banded with ochreous; hind leg more ochreous. Abdomen pale brown mixed with dark brown with ochreous segmental lines; caudal portion of abdomen whitish; dorsal crest on 1st segment and white.

Fore wing: White suffused with ochreous and pale brown; subbasal line represented by dark brown points on costa and discal cell; a dark brown costal patch triangular; antemedial line white, indistinct and almost straight from costa to inner margin; orbicular and claviform stigmata absent; an oblique dark brown discoidal lunule defined by white on inner side, fused with a large triangular brown costal patch at the inner extremity; small wedge-shaped ochreous mark above discoidal lunule; postmedial line white slightly defined by pale brown on inner side, angled inwards along the costal patch, then strongly excurved to vein 7, minutely waved to vein 5 and oblique to inner margin; three white costal spots beyond postmedial line; subterminal line white, slightly defined by dark brown on inner side; subterminal area pale brown suffused with white below costa and below vein 3; a terminal series of dark brown striae slightly defined by white on inner side; cilia brown mixed with ochreous.

Hind wing: White irrorated with brown; discoidal bar and terminal line dark brown; cilia brown with an indistinct ochreous line at the base through them.

Underside of fore wing: White densely irrorated with dark brown; costal area tinged with ochreous at the apex; dark brown terminal line.

Underside of hind wing: White; costal area sparsely irrorated with dark brown; discoidal point, postmedial line and obsolete subterminal line dark brown; terminal line dark brown; cilia more whitish.

Male external genitalia: Tegumen well sclerotized, tapering posteriorly and broadly swollen dorsomedially; vinculum slender, almost as deep as tegumen; saccus with a keel-like small process ventrally. Uncus falcate and densely long-haired. Valva short, 2.0 times as long as medially wide; costa narrow, gently descending distally at the base; dorsal margin of costa expanded inwards; a small weakly sclerotized process slightly

separated from the base of cucullus; cucullus dilating to rounded distal margin, and curved inwardly; dorsal margin of cucullus gently descending distally; harpe short; sacculus concaved at the middle of dorsal margin and without dentations; sacculi fused each other on the basal 1/2 of their dorsal margins. Juxta absent. Phallus very large; suprazonal sheath forming well sclerotized simple duct, curved ventrally and bottle neck-shaped apically; coecum short, 1/5 as long as subzonal sheath; cornuti represented by a long digitus-shaped process, which is slightly shorter than subzonal sheath, small sclerotized plate, and minute scattered spines; when the ductus ejaculatorius everted, this long process on the apical portion and others on the irregularly bulged portions.

Female terminalia: Seventh abdominal tergum large, excavated anteroventrally, and dilating posteriorly; posterior margin of 7th abdominal sternum strongly excavated at the middle.

Female genitalia: Ventromedial portion of 8th abdominal segment narrowly membranous; apophysis anterioris long, 2 times as long as 8th abdominal tergum; a small sclerotized bar posterior to the copulatory cavity; copulatory cavity broad, well sclerotized anteriorly and broadly concaved ventrally. Ductus bursae broad, well sclerotized, rather long, and as long as corpus bursae. Ductus seminalis slender, moderately long, 3 times as long as ductus bursae and bulged near vagina. Corpus bursae short; cervix bursae 2/3 as long as corpus bursae. Signa represented by a small irregularly shaped plate. Papilla analis sparsely long-haired and with rounded distal margin; apophysis posterioris slender and as long as apophysis anterioris; a long sclerotized plate on the ventromedial portion between papillae anales, tapering towards rounded distal margin and bearing minute spines apically.

Specimens examined: [Japan] 1 ♂, Mt. Yatsugatake, Nagano Pref., 20. viii. 1916, collector unknown (ELKU); 1 ♂, Mt. Sanage, Aichi Pref., 4. vi. 1976, B. TANAKA leg. (KMNHIR000, 150); 1 ♂, Mt. Yuno-yama, Mie Pref., 19. vi. 1966, B. TANAKA leg. (KMNHIR000, 151); 1 ♂, Kurama, Kyoto Pref., 21. vi. 1930, I. SUGITANI leg. (ELKU); 1 ♂, Takaoka, Morigauchi, Kōchi Pref., 20–21. vii. 1971, M. OWADA leg. (KMNHIR000, 152); 1 ♂, Mt. Hikosan, Fukuoka Pref., 19. vii. 1974, Y. YOSHIYASU leg. (KMNHIR000, 153); 1 ♀, Mt. Hikosan, Fukuoka Pref., 16. vii. 1933, T. ESAKI leg. (ELKU).

Distribution: Japan.

7-2. *Neustrotia costimacula* (OBERTHÜR, 1880)

(Figs., 65, 88–B)

Erastria costimacula OBERTHÜR, 1880, Ét. Ent. 5: 83, pl. 4, fig. 4.

Eustrotia costimacula: HAMPSON, 1910, Cat. Lepid. Phalaenae Br. Mus. 10: 603, pl. 166, fig. 29.

Unca costimacula: INOUE & SUGI, 1958, Check List of Lepid. Japan 5: 548.

Neustrotia costimacula: SUGI, 1982, In INOUE, H. et al., Moths of Japan 1: 820, 2: 384, pl. 197: 62.

Length of fore wing: 8–9 mm.

Frons pale brown mixed with white; vertex pale brown mixed with white; labial

palpus pale brown; antenna brown slightly ringed with white. Thorax dark brown at the base and white; collar dark brown; tegula dark brown basally and white from the basal 1/3 to apex; pleural area white; legs ochreous white; tarsi brown banded with ochreous white. Abdomen brown mixed with white and with white segmental rings.

Fore wing: White sparsely irrorated with dark brown; subbasal line represented by dark brown points on costa and discal cell; a dark brown triangular patch on costa; antemedial line white, indistinct and almost straight from costa to inner margin; orbicular and claviform absent; an oblique triangular dark brown discoidal mark, defined by white

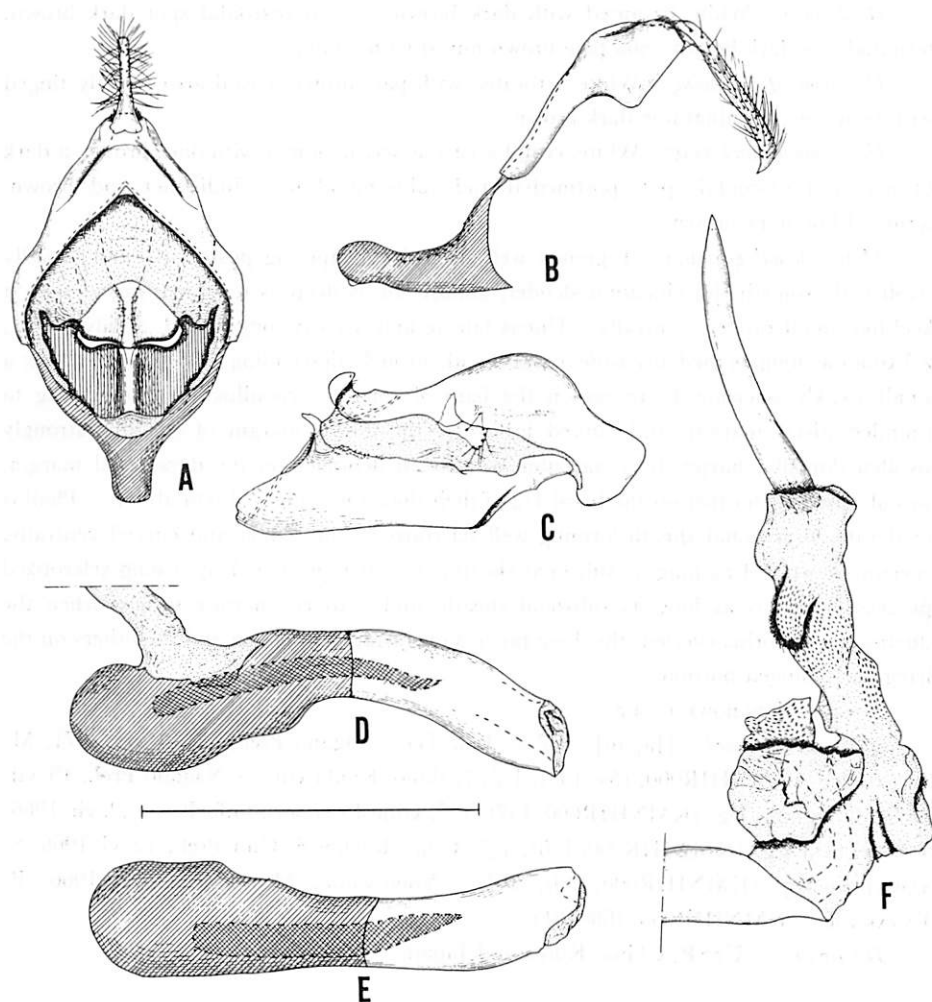


Fig. 65. Male external genitalia of *Neustrotia costimacula* (OBERTHÜR).

A: Ring in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Phallus in lateral view (left). E: Phallus in ventral view. F: Everted ductus ejaculatorius showing cornuti. Scale 1 mm.

except above and with a dark brown patch above it on costa; a waved and white line from the lower apex of discoidal mark to inner margin; postmedial line white, angled along a costal patch, strongly excurved below vein 7, then incurved and confluent with medial white line; three white costal spots beyond postmedial line; subterminal line white, slightly defined by dark brown spots angled inwards below costa, minutely waved and gradually incurved to vein 2; subterminal area suffused with dark brown and with a series of dark brown striae; a terminal series of white striae narrow; cilia dark brown suffused with chocolate-brown.

Hind wing: White irrorated with dark brown; a faint discoidal spot dark brown; terminal line dark brown; cilia pale brown mixed with white.

Underside of fore wing: White, irrorated with pale brown; costal area slightly tinged with ochreous; terminal line dark brown.

Underside of hind wing: White; costal area sparsely irrorated with dark brown; a dark brown faint discoidal spot; postmedial and subterminal lines indistinct and brown; terminal line dark brown.

Male external genitalia: Tegumen well sclerotized, tapering posteriorly and broadly swollen dorsomedially; vinculum slender, almost $3/4$ as deep as tegumen; saccus with a keel-like small process ventrally. Uncus falcate and densely long-haired. Valva short, 2.5 times as long as medially wide; costa broad, strongly descending distally at the base; a small weakly sclerotized process on the base of cucullus; cucullus slightly dilating to rounded distal margin, and curved inwardly; the dorsal margin of cucullus strongly swollen dorsally; harpe short; sacculus with small denticles on the dorsobasal margin; sacculi fused each other on the basal $1/2$ of their dorsal margins. Juxta absent. Phallus moderate; suprazonal sheath forming well sclerotized simple duct and curved ventrally; coecum short, $1/4$ as long as subzonal sheath; cornuti represented by a long sclerotized process, which is as long as subzonal sheath, and scattered minute spines; when the ductus ejaculatorius everted, this long process on the apical portion and the others on the irregularly bulged portion.

Female: Unknown to me.

Specimens examined: [Japan] 3 ♂♂, Ina, Tera, Nagano Pref., 14–18. viii. 1971, M. OWADA leg. (KMNHIR000, 154–156); 1 ♂, Nishino, Kaida village, Nagano Pref., 19. vii. 1969, B. TANAKA leg. (KMNHIR000, 157); 1 ♂, Gujo-Rokunori, Gifu Pref., 22. vii. 1966, S. SAWATANI leg. (KMNHIR000, 158); 1 ♂, Gujo-Rokunori, Gifu Pref., 12. vi. 1966, S. SAWATANI leg. (KMNHIR000, 159); 2 ♂♂, Yono-yama, Mie Pref., 19. vi. 1966, B. TANAKA leg. (KMNHIR000, 160–161).

Distribution: USSR, China, Korea and Japan.

7-3. *Neustrotia rectilineata* sp. nov.

(Figs., 66, 67, 88–C)

Length of fore wing: 8–9 mm.

Frons naked or pale brown ventrally, and white dorsally; vertex white; labial palpus pale brown mixed with white; 3rd segment tipped with white; antenna dark brown. Thorax white mixed with dark brown; collar dark brown and white or ochreous at the base; tegula dark brown at the base and white to apex; pleural area white; fore leg dark brown ringed with ochreous. Abdomen pale brown with white segmental lines; dorsal crest on 1st segment, dark brown and tipped with white.

Fore wing: White suffused with dark brown; subbasal line represented by dark brown points on costa and discal cell; triangular antemedial patch dark brown on costa; antemedial line white, irregularly defined by dark brown spots on each side; dark brown median shade dilating to vein 2, and suffused with golden brown to inner margin; reniform stigma with white annulus, slightly defined by dark brown and with two dark brown discoidal spots; the lower large and a yellow streak between them; a triangular costal patch above reniform dark brown and suffused with golden brown; postmedial line white slightly defined by dark brown on inner side, excurved at vein 7, minutely waved below it and straight below vein 3; three ochreous costal spots beyond postmedial line;

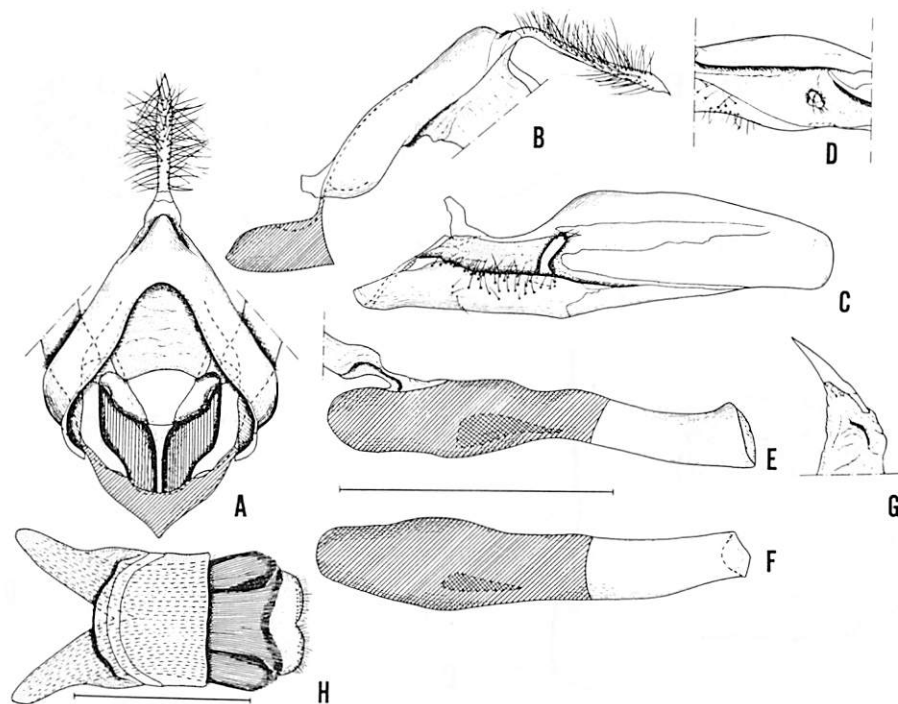


Fig. 66. Male external genitalia of *Neustrotia rectilineata* sp. nov.

A: Ring in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Anellifer showing a small process, in dorsal view. E: Phallus in lateral view (left). F: Phallus in ventral view. G: Apical portion of everted ductus ejaculatorius, showing an acute process. H: Hair pencils in ventral view. Scales 1 mm.

postmedial area suffused with dark brown below costa and below vein 6; subterminal line indistinct; except for the apex and tornus, subterminal area with a series of dark brown streaks, which are distinctly defined by white on outer side; long golden brown streaks from terminal line below each vein; terminal line chequered with golden brown and dark brown; cilia dark brown mixed with golden brown basally and brown tipped with white apically.

Hind wing: White irrorated with pale brown; terminal line dark brown; cilia brown and more whitish apically.

Underside of fore wing: Dark brown; costal area tinged with ochreous at apex; cilia dark brown.

Underside of hind wing: White sparsely irrorated with dark brown; costal area slightly tinged with ochreous; a dark brown discoidal spot; postmedial and subterminal lines dark brown, indistinct and waved; terminal line dark brown; cilia ochreous and more whitish

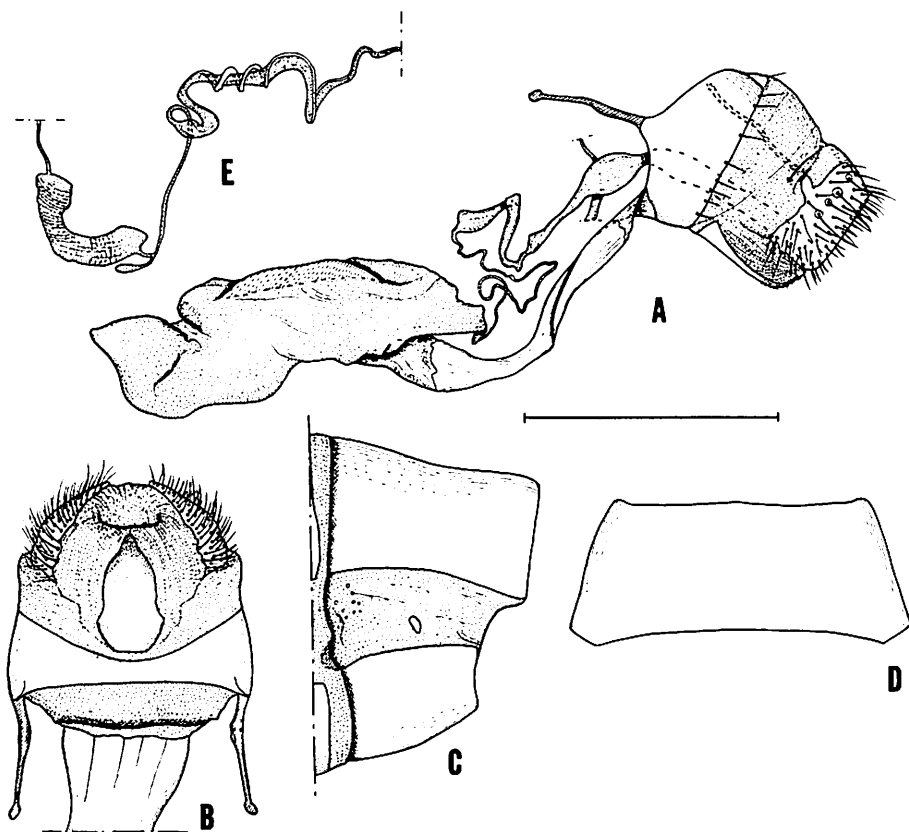


Fig. 67. Female genitalia and terminalia of *Neustrotia rectilineata* sp. nov.

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. E: Spermatheca and its gland. Scale 1 mm.

towards tornus.

Male external genitalia: Tegumen well sclerotized, tapering posteriorly and slightly swollen dorsomedially; vinculum slender, short, $2/5$ as deep as tegumen; saccus without ventral process. Uncus falcate and densely long-haired. Valva moderate, 3.5 times as long as medially wide; costa narrow, strongly descending distally at the base; a small process on the middle of anellifer near the base of cucullus, and curved dorsally; cucullus broad, strongly curved dorsally at the base, and with a long membranous incision from the base to apical $3/4$; harpe slender, long, $2/3$ as long as cucullus and tapering posteriorly; sacculi shallow and fused each other at the base. Juxta absent. Phallus moderate; suprazonal sheath well sclerotized simple duct and slightly dilating to apically; coecum short, $1/5$ as long a subzonal sheath; cornuti with a short, triangular and pointed apical process. Hair pencilis present between the saccus and the 8th abdominal sternum.

Female terminalia: Seventh abdominal sternum with straight posterior margin.

Female genitalia: Ventromedial portion of 8th abdominal segment well sclerotized and narrow; apophysis anterioris 1.5 times as long as 8th abdominal tergum; copulatory cavity broad, deep and well sclerotized. Ductus brusae moderately long, as long as corpus bursae and well sclerotized except for the anterior portion. Ductus seminalis slender, 2.5 times as long as ductus bursae. Corpus bursae short; cervix bursae $1/2$ as long as corpus bursae. Signa indistinct and represented by irregular sclerotized plates in corpus bursae. Papilla analis oblong and sparsely long-haired; apophysis posterioris 1.3 times as long as apophysis anterioris; a large sclerotized plate on the ventromedial portion between papillae anales, tapering posteriorly towards pointed tip and bearing minute spines apically.

Holotype ♂, Hotso, Nantou Hsien, 26–29. vi. 1973, M. OWADA leg. (KMNHIR000, 162).

Paratypes: [Taiwan] 2 ♂♂, same data as holotype (NSM); 2 ♂♂, same data as holotype (KMNHIR000, 163–164); 1 ♂, Kukuan in Tachiachi, Taichung Hsien, 25. v. 1973, Y. YOSHIYASU leg. (KMNHIR000, 165); 3 ♂♂, Lushan Hot Spring, Nantou Hsien, 13–14. viii. 1983, A. SEINO leg. (KMNHIR000, 166–168); 1 ♀, same data as holotype, (NSM); 1 ♀, same data as holotype (KMNHIR000, 169); 3 ♀♀, Lushan Hot Spring, Nantou Hsien, 13–14. viii. 1983, A. SEINO leg. (KMNHIR000, 170–172); [Korea] 1 ♂, Mt. Sudosan (700 m alt.), Kyongsangpuk-do, 9–12. vii. 1971, K. YAMAGISHI leg. (KMNHIR000, 173).

Distribution: Taiwan and Korea.

Remarks: This new species is similar to *N. noloides* and *N. sugii* in wing patterns, but they are distinguished from each other by the following character-states:

1. Postmedial line below vein 3 sinuous and strongly angled outwards below vein 2 *noloides*
- Postmedial line below vein 3 evenly excurved *sugii*
- Postmedial line below vein 3 more or less straight *rectilineata*
2. Postmedial area with 3 golden brown patches, below costa, at middle and on

- inner margin.....*noloides*
 - Postmedial area almost suffused with golden yellow..... *sugii*
 - Postmedial area suffused with dark brown below costa and below vein 6 .. *rectilineata*

7-4. *Neustrotia sugii* (TANAKA, 1973)
 (Figs., 68, 69, 88-D)

Eustrotia sugii TANAKA, 1973, *Kontyū*, Tokyo, 41 (1): 28, Figs. 7-8.

Neustrotia sugii: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 819, 2: 384, pl. 197: 60.

Length of fore wing: 9-11 mm.

Frons white mixed with pale brown; vertex white sparsely mixed with pale brown; labial palpus ochreous mixed with brown; antenna pale brown and sparsely mixed with white basally. Thorax white; collar ochreous mixed with brown; tegula white; pleural

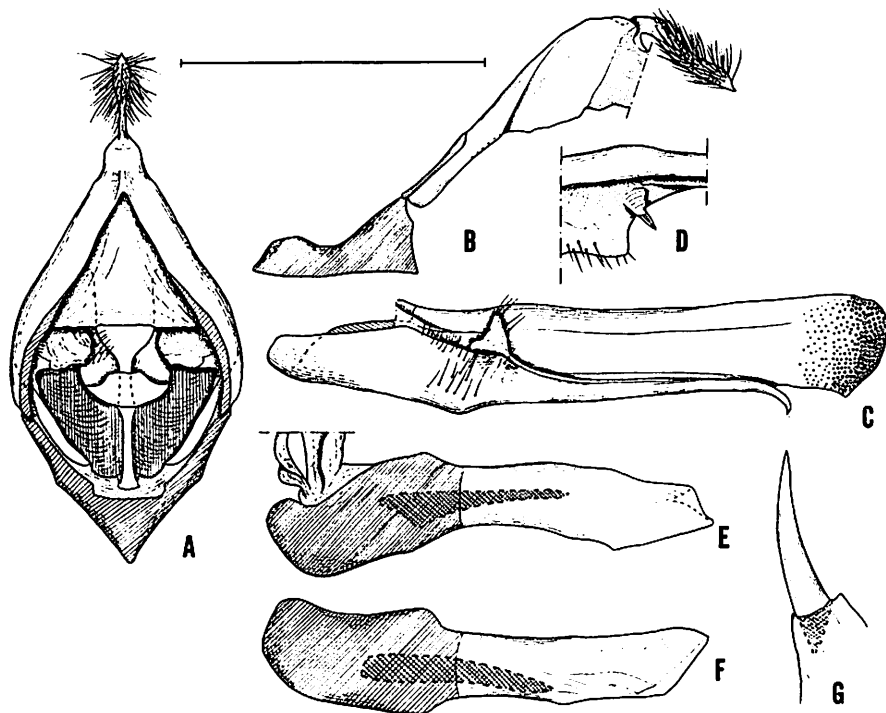


Fig. 68. Male external genitalia of *Neustrotia sugii* (TANAKA).

A: Ring in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Anellifer showing a small process in dorsal view. E: Phallus in lateral view (left). F: Phallus in ventral view. G: Apical portion of everted ductus ejaculatorius, showing an acute process. Scale 1 mm.

area white. Fore leg brown mixed with ochreous; fore tarsus brown mixed with golden yellow and banded with ochreous; mid and hind legs more whitish. Abdomen pale brown mixed with golden yellow; segmental lines ochreous; ventral portion of abdomen more whitish; dorsal crest on 1st segment and white mixed with brown.

Fore wing: White suffused with golden yellow; subbasal line represented by dark brown points on costa, and discal cell, and small brown streak on inner margin; antemedial patch on costa, indistinct, dark brown mixed with golden yellow; antemedial line indistinct; medial area sparsely suffused with dark brown below cell; golden yellow patches present above and below; reniform with white annulus bearing two dark brown discoidal points; the lower larger and the upper sometimes confluent with costal patch; a golden yellow streak between the discoidal points; a large costal patch above reniform and

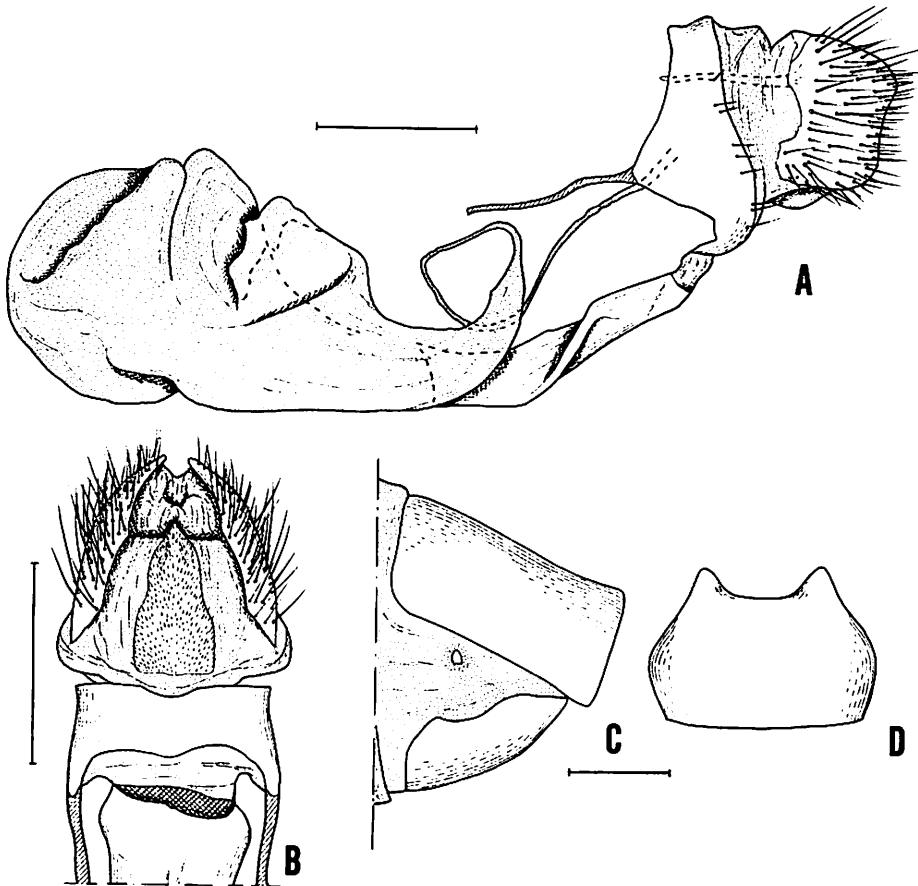


Fig. 69. Female genitalia and terminalia of *Neustrotia sugii* (TANAKA).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Seventh abdominal sternum in ventral view. Scales 1 mm.

dark brown mixed with golden yellow; postmedial line white, defined by dark brown on inner side, minutely waved from costa to veins 8 + 9, angled outwards at vein 7, sinuous to vein 4, evenly excurved below vein 3; postmedial area almost entirely suffused with golden yellow sparsely mixed with dark brown; three white costal points beyond the postmedial line; subterminal line white, defined by dark brown on inner side and sinuous; subterminal area with a series of dark brown streaks from veins 7 to 4; golden yellow streaks from terminal line below each vein; terminal line chequered with golden yellow and dark brown; cilia ochreous mixed with dark brown and golden yellow, and with a faint dark brown line at the middle.

Hind wing: White irrorated with pale brown; terminal line pale brown and indistinct; cilia ochreous mixed with pale brown and golden yellow.

Underside of fore wing: Brown irrorated with golden yellow; costal area tinged with ochreous at the apex; cilia white and tipped with brown.

Underside of hind wing: White sparsely irrorated with brown; costal area slightly tinged with ochreous; brown discoidal streak; postmedial and subterminal lines brown, indistinct and waved; terminal line brown and distinct; cilia white with an indistinct brown line at the middle.

Male external genitalia: Tegumen well sclerotized, tapering posteriorly and slightly concaved dorsomedially; vinculum short, about $1/3$ as deep as tegumen; saccus without ventral process. Uncus short and densely long-haired. Valva long, 6 times as long as medially wide; costa broad, gently descending distally; weakly sclerotized small process on the middle of anellifer near the base of cucullus and projected dorsally; cucullus long, uniformly sclerotized and ending in a rounded distal margin, which is pointed ventrodistally; harpe long, almost as long as cucullus, curved ventrally and ending in an acute tip; sacculi shallow and fused each other at the base. Juxta absent. Phallus moderate; the suprazonal sheath well sclerotized simple duct and curved ventrally; dorsal margin of subzonal sheath slightly swollen near zone; coecum short, $1/6$ as long as subzonal sheath; cornuti represented by a long pointed process, which is almost as long as subzonal sheath, and scattered small spines.

Female terminalia: Seventh abdominal segment tapering posteriorly; 7th abdominal sternum rather narrow and excavated at the middle of posterior margin.

Female genitalia: Ventromedial portion of 8th abdominal segment well sclerotized and broad; apophysis anterioris long and 2 times as long as 8th abdominal tergum; copulatory cavity broad, deep and well sclerotized. Ductus bursae rather short, $2/3$ as long as corpus bursae and well sclerotized. Ductus seminalis slender, about 1.5 times as long as ductus bursae. Corpus bursae short; cervix bursae almost as long as corpus bursae. Signa represented by irregular sclerotized plates in corpus bursae. Papilla analis oblong, slightly concaved at the distal margin and sparsely long-haired; apophysis posterioris rather short, $2/3$ as long as apophysis anterioris; a large sclerotized plate on the ventromedial portion between papillae anales, tapering posteriorly to pointed tip and bearing minute spines.

Specimens examined: [Japan] 1 ♂, Sakasamaki, Niigata Pref., 17. vii. 1960, H. MURAKI leg. (MURAKI Collection); 1 ♂, Gozenyama, Itoigawa, Niigata Pref., 27. vii. 1965, R. SATO leg. (KMNHIR000, 174); 1 ♀, Sakasamaki, Niigata Pref., 2. vii. 1960, R. SATO leg. (KMNHIR000, 175); 1 ♀, Tochio city, Niigata Pref., 7. vii. 1970, H. MURAKI leg. (MURAKI Collection); 1 ♀, Okutainai, Kurokawa, Niigata Pref., 26. vi. 1971, A. SEINO leg. (KMNHIR000, 176).

Distribution: Japan.

7-5. *Neustrotia noloides* (BUTLER, 1879)

(Figs., 70, 71, 88-E)

Acontia noloides BUTLER, 1879, *Ann. Mag. nat. Hist.* (5) 4: 366.

Eustrotia noloides: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 538, pl. 166, fig. 1.

Unca noloides: INOUE & SUGI, 1958, *Check List Lepid. Japan* 5: 548.

Neustrotia noloides: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 819, 2: 384, pl. 197: 59.

Length of fore wing: 8-9 mm.

Frons pale brown ventrally; dorsal half portion of frons and vertex white; labial palpus brown mixed with white; 3rd segment tipped with white; antenna dark brown, slightly tinged with ochreous basally. Thorax white; collar dark brown; tegula dark brown basally and white towards apex; pleural area white. Fore leg brown mixed with ochreous; fore tarsus banded with ochreous; mid and hind legs more whitish. Abdomen pale brown with white segmental lines; caudal portion of it whitish; dorsal crest on 1st segment, dark brown basally and white apically.

Fore wing: White suffused with golden brown; subbasal line represented by dark brown points on costa and discal cell; a triangular antemedial patch on costa, dark brown mixed with golden brown; antemedial line indistinct; medial area suffused with dark brown below cell; golden brown patches present above and below; reniform with white annulus bearing two dark brown discoidal points; the lower larger; a golden yellow streak between them; a large costal patch dark brown mixed with golden brown above reniform; postmedial line white, defined by dark brown and golden brown on inner side, from costa angled outwards at vein 7, sinuous below vein 3, strongly angled outwards below vein 2, then excurved; postmedial area mixed with brown and bearing 3 golden brown patches below costa, at middle and on inner margin; three white costal points beyond the postmedial line; subterminal line white, indistinct and curved inwards below costa and vein 3; subterminal area, except for the apex and tornus, with a series of dark brown streaks, which are defined by white on each side; golden brown streaks from terminal line below each vein; terminal line golden brown; cilia dark brown mixed with white.

Hind wing: White irrorated with pale brown; terminal line pale brown; cilia ochreous mixed with pale brown.

Underside of fore wing: Dark brown, irrorated with golden brown; costal area slightly

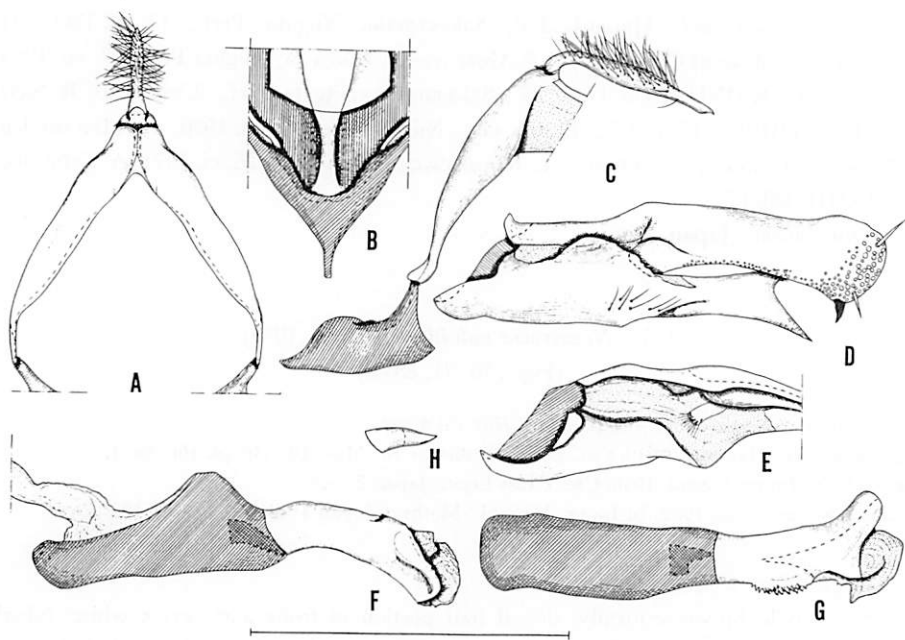


Fig. 70. Male external genitalia of *Neustrotia noloieds* (BUTLER).

A: Dorsum in dorsal view. B: Anterior portion of ring in dorsal view. C: Ring in lateral view (left). D: Right valva, inner view. E: Anellifer showing a small process in dorsal view. F: Phallus in lateral view (left). G: Phallus in ventral view. H: Cornutus. Scale 1 mm.

tinged with ochreous at the apex.

Underside of hind wing: White irrorated with pale brown; a dark brown discoidal spot; postmedial and subterminal lines indistinct and pale brown; terminal line dark brown.

Male external genitalia: Tegumen well sclerotized, tapering posteriorly and concaved dorsomedially; vinculum short, almost $3/7$ as deep as tegumen; saccus without ventral process. Uncus falcate, slightly broadened at the middle and densely long-haired. Valva moderate, 4 times as long as medially wide; costa broad, slightly descending distally at the base; a small process on the base of cucullus; cucullus curved ventrally, and with rounded distal margin, which is bearing broad hairs and large acute process ventrally; harpe broad, apically bifurcated, and both of its tips pointed; sacculus swollen dorsally beyond the middle of dorsal margin; sacculi fused with each other at the base. Juxta absent. Phallus moderate; suprazonal sheath well sclerotized simple duct, curved ventrally, with small denticles on the right lateral wall and its left apical portion expanded laterally; dorsal margin of subzonal sheath strongly swollen beyond the middle; coecum short, $1/7$ as long as subzonal sheath; cornuti with a short, pointed and triangular apical process.

Female terminalia: Dorsal margin of 7th abdominal sternum projected dorsally

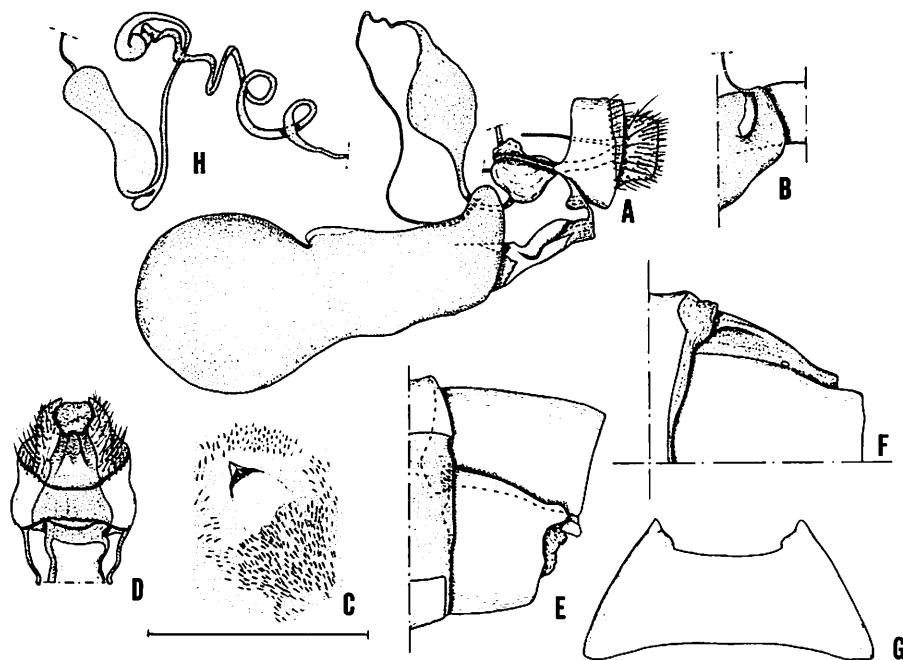


Fig. 71. Female genitalia and terminalia of *Neustrotia noloides* (BUTLER).

A: Whole genitalia in lateral view (left). B: Cervix bursae in ventral view. C: Signa. D: Ostium in ventral view. E: Female terminalia in lateral view (left). F: Seventh abdominal tergum (right half) in dorsal view. G: Seventh abdominal sternum in ventral view. H: Spermatheca and its gland. Scale 1 mm.

beyond the ventral margin of the tergum; in ventral view, 7th abdominal sternum broad, tapering posteriorly and bearing pointed processes at the extremities; lateral membranous region of 7th abdominal segment narrow in dorsal view.

Female genitalia: Ventromedial portion of 8th abdominal segment broadly membranous; apophysis anterioris slender and slightly longer than 8th abdominal tergum; copulatory cavity moderate, shallow and well sclerotized anteriorly. Ductus bursae short, $1/3$ as long as corpus bursae and well sclerotized except for anterior portion. Ductus seminalis slender, long, 5 times as long as ductus bursae and bulged beyond the middle. Corpus bursae long; cervix bursae $1/4$ as long as corpus bursae. Signa represented by a small triangular plate with swollen apex and minute spines around this plate. Papilla analis oblong and sparsely long-haired; the ventral margin of it slightly curved dorsally; apophysis posterioris 1.5 times as long as apophysis anterioris; a long sclerotized palte on the ventromedial portion between papillae anales, tapering towards rounded distal margin and bearing minute spines beyond the middle.

Specimens examined: [Taiwan] 2 ♂♂, Lushan Hot Spring, Nantou Hsien, 19–21. iii. 1972, M. OWADA leg. (NSM); 1 ♂, Kukuan in Tachiachi, Taichung Hsien, 27. v. 1973, Y.

YOSHIYASU leg. (KMNHIR000, 177); 3 ♂♂ 2 ♀♀, Lushan Hot Spring, Nantou Hsien, 13–14. viii. 1983, A. SEINO leg. (KMNHIR000, 178–182); [Japan] 2 ♂♂, Kurama, Kyoto Pref., 20. vi. 1925, I. SUGITANI leg. (ELKU); 1 ♂, Mika, Befu, Kōchi Pref., 22–23. vii. 1971, M. OWADA leg. (KMNHIR000, 183); 5 ♂♂, Tsutsu, Tushima Is., Nagasaki Pref., 26. v. 1930, T. ESAKI leg. (ELKU); 1 ♂, Mt. Sobosan, Ōita Pref., 3. vii. 1932, HORI, FUJINO et CHŌ leg. (ELKU); 1 ♀, Myozai, Shosanji, Tokushima Pref., 31. vii. 1971, M. OWADA leg. (KMNHIR000, 184).

Distribution: Taiwan and Japan.

7–6. Phylogenetic relationships in the genus *Neustrotia* (Fig. 72).

This genus was erected by SUGI (1982) for five species; *noloides*, *sugii*, *japonica* and *costimacula*, which have been included in the genus *Eustrotia*, and *albicincta* which has been included in the genus *Hyperstrotia*. As the lack of enough materials, the systematic position of *albicincta* is not inferred in this paper. Therefore the following discussion is based on the former 4 species and *rectilineata* sp. nov.

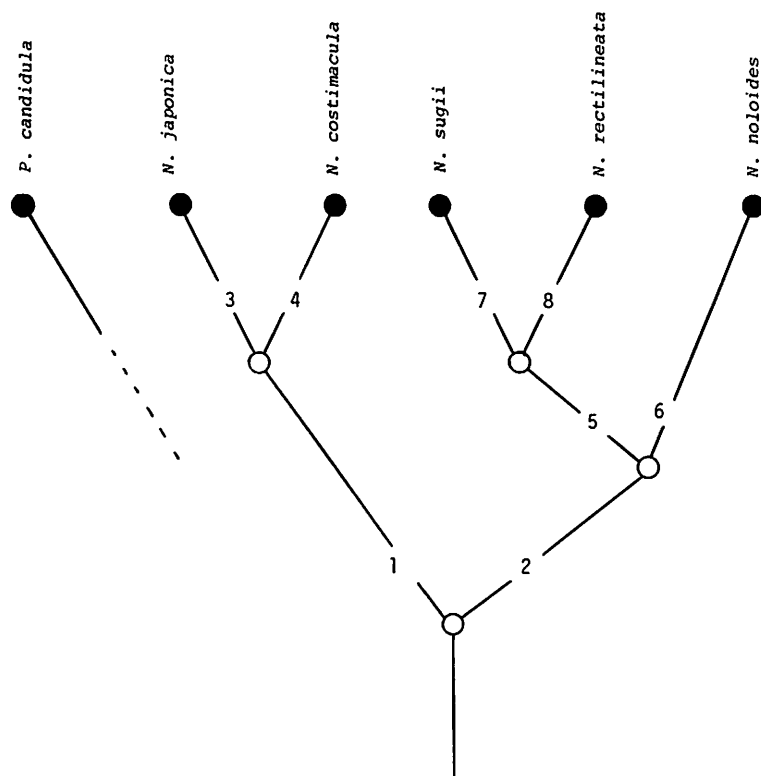


Fig. 72. Inferred phylogenetic relationships in the genus *Neustrotia*.

The genus *Neustrotia* is characterized by the following many autapomorphies; juxta absent, bases of both sacculi fused each other ventromedially, small plate or process present on the middle portion of anellifer, vesica very large, a large acute process present in the cornuti and triangular plate present ventromedially on the membranous region between papillae anales. Three monophyletic subgroups: the *japonica*-, the *sugii*- and the *noloides*-subgroups are recognized. The autapomorphies, interspecific relationships of each subgroup and the phylogenetic relationships among the subgroups are discussed as follows.

(1) the *japonica*-subgroup: This subgroup consists of *japonica* and *costimacula*. It is characterized by an autapomorphy; cucullus more or less curved inwardly (Fig. 72-1). Phallus greatly enlarged in *japonica*. On the other hand, minute serrations present basally on the dorsal margin of sacculus in *costimacula* (Fig. 72-3, 4).

(2) the *sugii*-subgroup: This subgroup consists of *sugii* and *rectilineata*. It is characterized by the following autapomorphy; a small process present on the anellifer (Fig. 72-5). *N. rectilineata* is specialized in bearing hair pencilis between the saccus and 8th abdominal sternum. On the other hand, apical portion of harpe acute and curved ventrally in *sugii* (Fig. 72-8,7).

(3) the *noloides*-subgroup: This subgroup includes only *noloides*. It is characterized by the following autapomorphies; harpe completely separated from cucullus, dorsal margin of subzonal sheath swollen near zone and carina penis developed (Fig. 72-6).

(4) the phylogenetic relationships of the 3 subgroups: It is inferred that the *sugii*- and the *noloides*-subgroups form a monophyletic group based on the following synapomorphy; harpe elongated and almost as long as cucullus (Fig. 72-2). This structure is retained in the plesiomorphic state in the *japonica*-subgroup and it is inferred that the *japonica*-subgroup has a sister-group relationship with a monophyletic group including the *sugii*- and *noloides*-subgroups.

8. Genus *Pseudeustrotia* WARREN, 1913

Pseudeustrotia WARREN, 1913, In Seitz Gross-Schmett. Erde 11: 288.

Type-species; *Noctua candidula* Denis & Schiffermüller, 1775, Ankündigung syst. Werkes Schmett.

Winergegend: 89, by original designation.

8-1. *Pseudeustrotia candidula* (DENIS and SCHIFFERMÜLLER, 1775)

(Figs., 73, 74, 88-F)

Noctua candidula DENIS and SCHIFFERMÜLLER, 1775, Ankündigung syst. Werkes Schmett. Winergegend: 89.

Eustrotia candidula: HAMPSON, 1910, Cat. Lepid. Phalaenae Br. Mus. 10: 581.

Pseudeustrotia candidula: WARREN, 1913, In Seitz Gross-Schmett. Erde 11: 288.

Eustrotia candidula: KARSHOLT & NIELSEN, 1976, Systematisk fortegnelse over Danmarks sommerfugle: 71.

Pseudeustrotia candidula: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 820, 2: 384, pl. 197: 63.

Length of fore wing: 10–12 mm.

Frons fuscous mixed with white; vertex whitish; labial palpus dark brown slightly mixed with rufous brown and tipped with ochreous white of 3rd segment; antenna dark

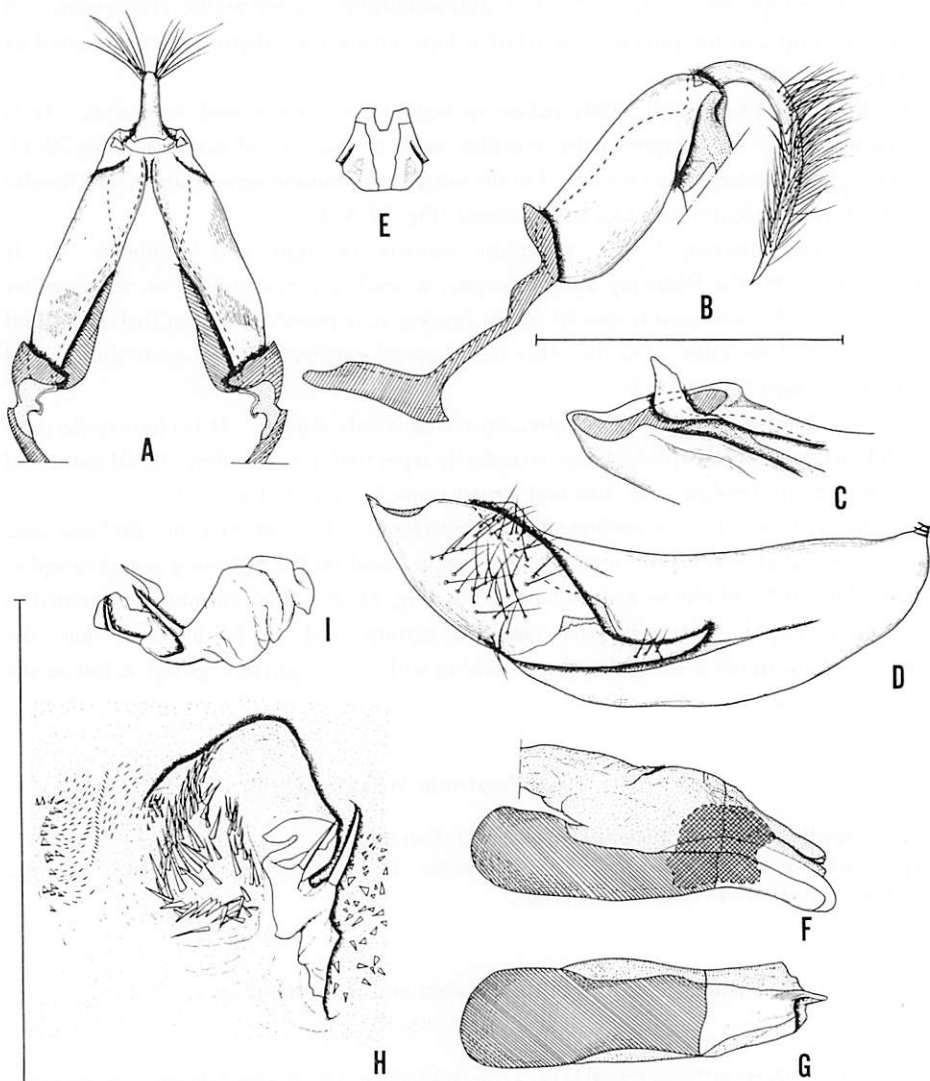


Fig. 73. Male external genitalia of *Pseudeustrotia candidula* (DENIS and SCHIFFERMÜLLER).
 A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Basal portion of right valva, showing costa. D: Right valva, inner view. E: Juxta. F: Phallus in lateral view (left). G: Phallus in ventral view. H: Cornuti. I: Middle plate of cornuti in lateral view. Scales 1 mm.

brown, covered with white dorsally. Thorax snowy white sparsely mixed with dark brown; a dark brown transverse line at the middle; posterior portion of thorax dark brown; pleural area white; legs dark brown mixed with ochreous white; tarsi dark brown ringed with ochreous. Abdomen fuscous suffused with white, more whitish anteriorly; dorsal crest on 1st segment, white and tipped with black; brush organ present on 2nd abdominal segment of male.

Fore wing: White; brown basal patch on costa; subbasal line dark brown, excurved below costa and curved outwards to vein 1; antemedial line white, irregularly defined by dark brown on each side, oblique and sinuous from costa to inner margin; olive-brown median shade beyond antemedial line from cell to inner margin; orbicular indistinct, with dark brown spots; claviform untraceable; reniform with dark brown annulus, which is open above and constricted at the middle; a large triangular dark brown patch extending on costa from the middle to apex, and to lower angle of cell; postmedial line white, defined by dark brown on inner side, angled outwards below costa, waved to vein 4, then curved inwards to inner margin; postmedial area white and suffused with pale olive-brown except for the costal area; subterminal line broad and white, slightly excurved below vein 7; a terminal series of faint dark brown striae, defined by white on inner side; cilia ochreous brown and white with fine brown line at the middle through them.

Hind wing: White sparsely irrorated with pale brown; a faint discoidal streak;

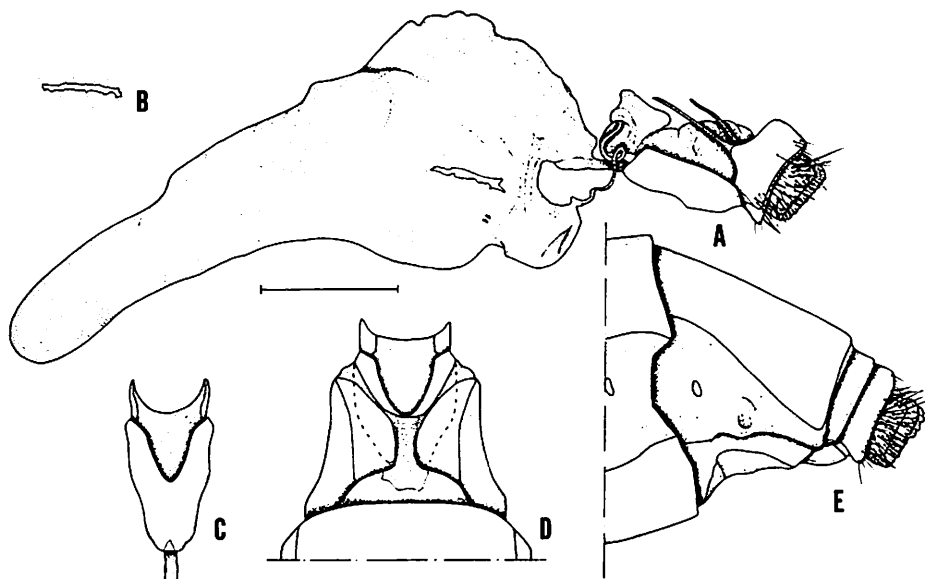


Fig. 74. Female genitalia and terminalia of *Pseudeustrotia candidula* (DENIS and SCHIFFER-MÜLLER).

A: Whole genitalia in lateral view (left). B: Right signum. C: Ostium in ventral view. D: Seventh abdominal sternum in ventral view. E: Female terminalia in ventral view (left). Scale 1 mm.

postmedial line waved; a dark brown terminal line; cilia white with a dark brown line at the middle through them.

Underside of fore wing: Pale brown; costal area and subterminal area ochreous white; cilia ochreous white and tipped with pale brown.

Underside of hind wing: White sparsely mixed with brown; discoidal spot, waved postmedial and subterminal lines dark brown; a faint terminal series of striae brown; cilia white.

Male external genitalia: Tegumen rather broad and tapering posteriorly; fenestrula narrow and separated into sclerotized medial portion and weakly sclerotized lateral portions; peniculus moderate; vinculum narrow and as deep as tegumen; saccus large. Uncus well sclerotized, slender, falcate and densely long-haired beyond the basal 1/4. Valva long, 4 times as long as medially wide, almost subequal through its length and evenly curved dorsally; costa broad, with twisted and dorsally produced basal portion, and gradually descending distally; cucullus + harpe long, with a narrow membranous incision from anellifer at the base and ended in an acute tip with minute spines; sacculus large, posterodistally with a long process, which is curved dorsally and ended in an acute tip; the dorsal margin of sacculus swollen at the middle and almost reaching to the dorsal margin of costa. Juxta trapezoidal, weakly sclerotized ventromedially and its posterior margin excavated at the middle. Phallus short; sclerotized ventral portion of suprazonal sheath abruptly narrowed apically; coecum moderate, 1/3 as long as subzonal sheath; cornuti large, represented by irregularly swollen central plate with long and acute spines apically, left group of short and acute spines, and spinules scattered around central plate.

Female terminalia: Seventh abdominal segment tapering posteriorly; a small depression on the lateral membranous area beyond the middle; 7th abdominal sternum membranous ventromedially.

Female genitalia: Eighth abdominal tergum well sclerotized; apophysis anterioris long, 1.5 times as long as 8th abdominal tergum; copulatory cavity deep, uniformly sclerotized ventrally and with strongly excavated posterior margin. Ductus brusae very short, 1/16 as long as corpus bursae. Ductus seminalis short, 4 times as long as ductus bursae and bulged near the vagina. Corpus bursae large and tapering to apex; cervix bursae short. Signa represented by narrow sclerotized plates on each side. Papilla analis truncated and sparsely long-haired; apophysis posterioris almost as long as apophysis anterioris.

Specimens examined: [Finland] 1 ♂, ES. Mäntyharju, Suomi, 24. vi. 1946, O. PELTONEN leg. (KMNHIR000, 185); 1 ♀, Kuolemajärvi, 8. vii. 1926, M. IVASCHIVZEFF leg. (KMNHIR000, 186); [Denmark] 2 ♂♂, data unknown, (KMNHIR000, 187–188); [Japan] 1 ♂, Mt. Yunomaru, Nagano Pref., 28. vii. 1919, I. SUGITANI leg. (ELKU); 1 ♂, Mt. Yunomaru, Nagano Pref., 30. vii. 1922, I. SUGITANI leg. (ELKU); 1 ♀, Kumanotaira, Wakayama Pref., 21. vii. 1925, I. SUGITANI leg. (ELKU).

Distribution: Europe, USSR, Korea and Japan.

Remarks: WARREN (1913) erected the genus *Pseudeustrotia* for *candidula* and other 7

species which are distributed in Indo-australian region, because he considered that the character-states of fore wing 1A and valvae in these species are different from those of the species included in the genus *Eustrotia*. SUGI (1982) used *Pseudeustrotia* for *candidula* and tentatively assigned *Eustrotia bipartita* WILEMAN to this genus. As already mentioned in the description, *candidula* is rather isolated species from the species treated in this paper, and has many specialized character-states; 1) posterior margin of sacculus bearing a large acute process, 2) brush organ present on the 2nd abdominal segment of male, 3) 7th abdominal sternum membranous ventromedially. As the lack of enough materials of *bipartita* and other Indo-australian species, the systematic position of this species and the genus is unknown to me at the present.

9. Genus *Maliattha* WALKER, 1863

Key to the species

Male

1. Costa narrow and without processes at the base; ampulla, if it is present, forming a process; ventral margin of tegumen not projected dorsally 2
- Costa with a large process at the base; ampulla strongly swollen dorsally, and without processes; ventral margin of tegumen projected dorsally beyond the middle portion of tegumen *culta*
2. Ampulla absent; ventral portion of subzonal sheath uniformly sclerotized 3
- Ampulla present; ventral portion of subzonal sheath with large membranous incision near the zone *signifera*
3. Apical portion of suprazonal sheath with minute apines dorsally 4
- Apical portion of suprazonal sheath without apines 5
4. Uncus slender, ended in sharply pointed tip and almost 2/3 as long as tegumen; valva almost subequal through its length *vialis*
- Uncus broad, short, ended in a truncated tip and almost 3/8 as long as tegumen; valva strongly tapering distally *bella*
5. Anellifer broad; vinculum rather broad, 1/2 as deep as tegumen *rosacea*
- Anellifer narrow; vinculum short, slender, almost 1/4 as deep as tegumen ... *arefacta*

Female

1. Ductus bursae with a membranous pouch near copulatory cavity 2
- Ductus bursae without membranous pouch 3
2. A large membranous pouch present on lateral membranous region of 7th abdominal segment; ventral portion of copulatory cavity sclerotized; corpus bursae moderate, almost as long as ductus bursae *signifera*
- Membranous pouch absent on lateral membranous region of 7th abdominal segment; ventral portion of copulatory cavity membranous; corpus bursae long and slender, almost 2 times as long as ductus bursae *rosacea*
3. Seventh abdominal tergum well sclerotized dorsomedially; lateral membra-

- nous region present on 7th abdominal segment..... 4
- Seventh abdominal tergum broadly membranous dorsomedially; lateral membranous region absent on 7th abdominal segment *culta*
4. Signa present; ventral portion of copulatory cavity membranous 5
- Signa absent; ventral portion of copulatory cavity sclerotized.....*arefacta*
5. Signa represented by minute spines; posteroventral portion of 7th abdominal tergum produced ventrally *bella*
- Signa represented by small plate, which is concaved at the middle; posteroventral portion of 7th abdominal tergum not produced ventrally *vialis*

9-1. *Maliattha signifera* (WALKER, 1857)
(Figs., 26, 27, 29-C)

Acontia signifera WALKER, 1857, List Specimens Lepid. Insects Colln Br. Mus. 12: 793.

Lithacodia signifera: HAMPSON, 1910, Cat. Lepid. Phalaenae Br. Mus. 10: 504.

Maliattha signifera: WARREN, 1912, in Seitz, Gross-Schmett. Erde 3: 276, t. 51 m.

Maliattha signifera: INOUE & SUGI, 1958, Check List Lepid. Japan 5: 543.

Maliattha signifera: SUGI, 1982, In INOUE, H. et al., Moths of Japan 1: 814, 2: 382, pl. 197: 7-9.

Length of fore wing: 8-9 mm.

Frons and vertex white mixed with brown; labial palpus dark brown mixed with ochreous; 2nd segment ochreous white basally; 2nd and 3rd segments tipped with ochreous white; antenna brown ringed with pale white. Thorax white mixed with brown; pleural area white. Fore leg dark brown mixed with white; mid and hind legs more whitish; tarsi dark brown ringed with ochreous white. Abdomen white, sparsely mixed with brown; dorsal crests on 1st to 4th segments; 1st and 2nd segments white; 3rd and 4th segments black.

Fore wing: White suffused with golden brown; basal area with two costal marks; the inner one golden brown and defined by dark brown subbasal line on outer side; the outer one smaller, golden brown mixed with dark brown; subbasal line interrupted in cell; antemedial line white and brown, slightly defined by pale brown on inner side, and clearly defined by dark brown on outer side, obliquely excurved and sinuous; medial area golden brown with a dark brown sinuous medial line on the middle; reniform with white elliptical mark and two dark brown discoidal spots; a dark brown streak from reniform to postmedial line; postmedial line white, defined by golden brown on outer side, oblique from costa to vein 7, slightly excurved and minutely waved to vein 4, incurved to the middle of 2nd cell and excurved; three white costal spots beyond postmedial line; postmedial area with dark brown wedge-shaped striae and golden brown streaks, which are teaching to termen; subterminal line white, faint and excurved below vein 7 and at the middle; terminal line dark brown, interrupted by golden brown streaks at the middle of each cell; cilia ochreous white mixed with dark brown and with an indistinct dark brown medial line through them.

Hind wing: White irrorated with brown beyond the middle; terminal line dark brown; cilia white with a dark brown line at the middle through them.

Underside of fore wing: White irrorated with dark brown; costal and terminal areas tinged with ochreous; a terminal series of dark brown striae; cilia dark brown mixed with ochreous.

Underside of hind wing: White and sparsely irrorated with brown; costal area tinged with ochreous; a discoidal spot and indistinct postmedial line dark brown; a terminal series of dark brown striae; cilia ochreous white with a dark line through them.

Male external genitalia: Tegumen moderate and slightly concaved middorsally; vinculum slender and $1/2$ as deep as tegumen; saccus short, projecting dorsally and ended in a pointed tip. Uncus long, $2/3$ as long as tegumen, weakly sclerotized at the base, tapering to blunt tip and densely long-haired; process of uncus long, dilating to concaved anterior margin. Valvae moderate and asymmetrical to each other. Right valva long, 5 times as long as medially wide; costa very narrow and gently descending distally; cucullus + harpe large, strongly curved dorsally and bearing small acute processes apically; ampulla with two large processes; one produced basally, almost straight and tapering towards blunt tip; the other produced apically, curved dorsally and ended in an acute tip; sacculus moderate; long and slender process on the dorsobasal margin of sacculus. Left valva almost same as the right valva, but left ampulla with a large process, which is produced basally and ended in an acute tip with a spine. Juxta small, almost elliptical, swollen ventromedially, and with slightly excavated distal end. Phallus short; the sclerotized portion of suprazonal sheath moderately broad and strongly curved ventrally; minute spines near the opening of ductus ejaculatorius; ventral portion of subzonal sheath with large membranous incision near zone; coecum small, $1/4$ as long as subzonal sheath.

Female terminalia: A large membranous pouch present on lateral membranous region of 7th abdominal segment; minute spines on its inner wall.

Female genitalia: Eighth abdominal tergum well sclerotized; apophysis anterioris slender and as long as 8th abdominal tergum; copulatory cavity small, and with trapezoidal sclerotized portion ventrally. Ductus bursae long, as long as corpus bursae and with large membranous pouch posteroventrally. Ductus seminalis long, 1.5 times as long as ductus bursae and bulged near the vagina. Corpus bursae small; cervix bursae short, $1/3$ as long as corpus bursae. Signa absent. Papilla analis small, sparsely short-haired; apophysis posterioris long, 1.5 times as long as apophysis anterioris.

Specimens examined: [Taiwan] 1 ♂, Mt. Shihtoushan, Miaoloi-Hsien, 10. vi. 1975, K. UEDA et K. SETOYA leg. (KMNHIR000, 189); 1 ♀, Mt. Shihtoushan, Miaoloi-Hsien, 9. vi. 1975, K. UEDA et K. SETOYA leg. (KMNHIR000, 190). [Japan] 1 ♂, Sakasamaki, Niigata Pref., 17. vii. 1960, H. MURAKI leg. (MURAKI Collection); 1 ♂, Izashiki, Kagoshima Pref., 22. vi. 1957, T. SAIGUSA leg. (KMNHIR000, 191); 1 ♂, Shinmura, Amami Is., Kagoshima Pref., 22. viii. 1973, Y. YOSHIYASU leg. (KMNHIR000, 192); 1 ♂, Mt. Bannadake, Ishigaki Is., Okinawa Pref., 29. v. 1973, K. UEDA leg. (KMNHIR000, 193); 1 ♀, Oginojo, Niigata Pref., 7. viii. 1959, H. MURAKI leg. (MURAKI Collection); 1 ♀,

Mt. Hikosan, Fukuoka Pref., 12. vii. 1958, K. YANO leg. (ELKU); 1 ♀, Mt. Ariake, Tsushima Is., Nagasaki Pref., 5. ix. 1973, K. UEDA leg. (KMNHIR000, 194); 1 ♀, Mt. Bannadake, Ishigaki Is., Okinawa Pref., 31. v. 1973, K. UEDA leg. (KMNHIR000, 195).

Distribution: India, Burma, Malaysia, Philippines, China, Taiwan, Korea and Japan.

9-2. *Maliattha rosacea* (LEECH, 1889)
(Figs., 75, 76, 88-G)

Erastria rosacea LEECH, 1889, *Proc. Zool. Soc. Lond.* 1889: 527, pl. 53, fig. 9.

Lithacodia rosacea: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 530.

Jaspidia rosacea: INOUE & SUGI, 1958, *Check List Lepid. Japan* 5: 545.

Maliattha rosacea: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 815, 2: 383, pl. 197: 15.

Length of fore wing: 9-10 mm.

Frons brown mixed with pink and white; vertex more whitish; labial palpus dark brown slightly mixed with white and tipped with ochreous white on 2nd and 3rd segments; antenna brown ringed with ochreous white. Thorax dark brown mixed with pink and white; pleural area white. Fore leg dark brown mixed with ochreous white; fore tarsus banded with ochreous white; hind leg more whitish. Abdomen dark brown mixed with ochreous white; caudal portion of abdomen whitish; dorsal crests on 2nd to 5th segments; 2nd pale brown and small, 3rd dark brown and small, 4th dark brown and large, and 5th dark brown and moderate.

Fore wing: Dark brown suffused with reddish brown and pink; subbasal line dark brown, defined by pink on each side and sinuous from costa to inner margin; a dark brown streak in discal cell; antemedial line white, defined by dark brown on each side, waved from costa and strongly excurved below cell; orbicular and claviform with rounded white annuli, confluent with each other on discal cell and forming 8 figure-shaped mark; the former filled with dark brown, and the latter reddish brown; medial area dark brown suffused with reddish brown and a dark brown streak in submedian fold; reniform with white annulus and elliptical; a dark brown line from the lower angle of cell, incurved at vein 2, attached on the submedian streak and to inner margin; postmedial line white mixed with pink, slightly defined by dark brown on inner side, curved inwards below costa, angled outwards at vein 8, minutely waved, curved inwards below vein 4 and excurved below vein 2; two white costal spots beyond postmedial line; subterminal line pinkish white, excurved below vein 7 and at the middle; a terminal series of dark brown striae; cilia pinkish white with a brown line at the middle through them; apical portion of cilia mixed with brown.

Hind wing: White irrorated with brown; a dark brown terminal line; cilia ochreous white with a brown line at the middle.

Underside of fore wing: Dark brown; costal and terminal areas tinged with ochreous white.

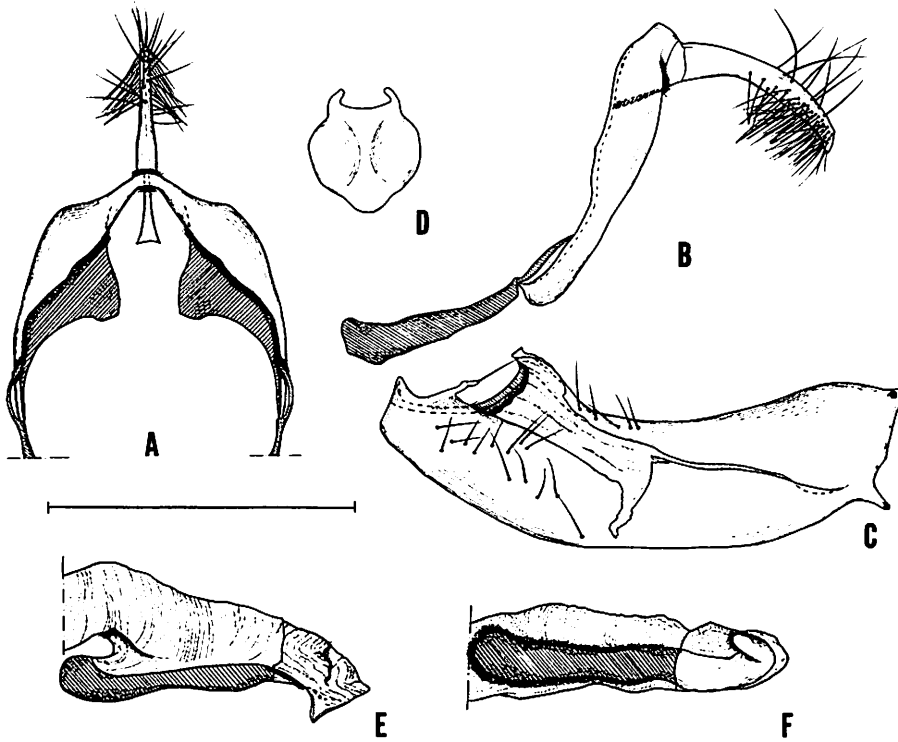


Fig. 75. Male external genitalia of *Maliaattha rosacea* (LEECH).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. Scale 1 mm.

Underside of hind wing: White, sparsely mixed with brown and ochreous; a discoidal spot and waved postmedial line brown; a terminal series of dark brown striae; cilia whitish.

Male external genitalia: Tegumen moderate and narrow dorsomedially; vinculum rather broad, and $1/2$ as deep as tegumen; saccus moderate and not produced dorsally. Uncus broad, long, $2/3$ as long as tegumen, weakly sclerotized basally, strongly curved ventrally and ended in a blunt tip; ventral portion of uncus densely long-haired beyond the middle; process of uncus long and dilating anteriorly. Valva moderate, 4 times as long as medially wide, almost subequal through its length and gently curved dorsally; costa narrow and strongly descending distally; cucullus and harpe long, separated by membranous incision from anellifer, and fused with each other apically; two acute processes on cucullus + harpe distally; sacculus moderate and with a short process dorsobasally, which is bearing a long seta apically. Juxta small, swollen ventromedially, and bearing two short processes posterodistally. Phallus short; the sclerotized portion of suprazonal sheath moderately broad, strongly curved ventrally and ended in a blunt tip; coecum small, $1/5$ as long as subzonal sheath.

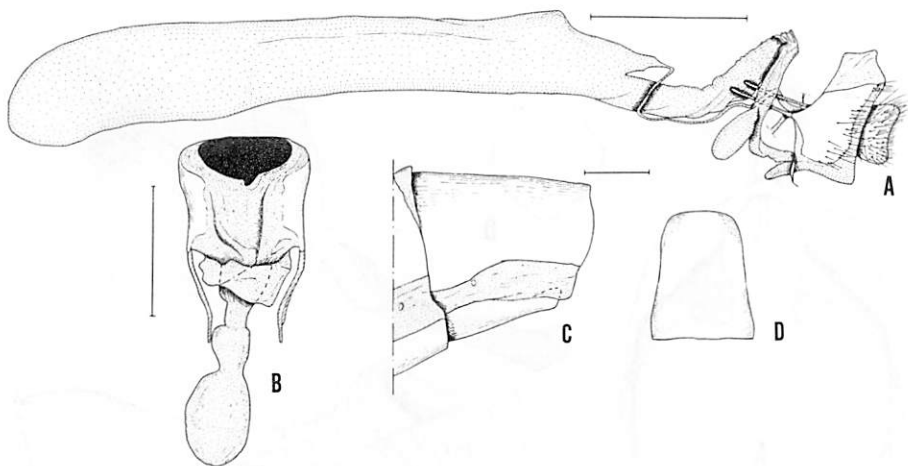


Fig. 76. Female genitalia and terminalia of *Maliaattha rosacea* (LEECH).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in ventral view (left). D: Seventh abdominal sternum in ventral view. Scales 1 mm on A, C and D, 0.5 mm on B.

Female terminalia: Seventh abdominal segment without membranous pouch on its lateral membranous region.

Female genitalia: Eighth abdominal tergum well sclerotized; apophysis anterioris as long as 8th abdominal segment; copulatory cavity small and membranous. Ductus bursae short, $1/2$ as long as corpus bursae, strongly produced dorsally, then bent downwards; a small membranous pouch present on the posterior portion near copulatory cavity. Ductus seminalis rather short, $2/3$ as long as ductus bursae. Corpus bursae slender and long; cervix bursae short. Signa absent. Papilla analis moderately large and with a concaved distal margin; apophysis posterioris long, 1.5 times as long as apophysis anterioris.

Specimens examined: [Japan] 1 ♂, Todai, Kamiina, Nagano Pref., 7. vii. 1970, M. OWADA leg. (KMNHIR000, 196); 2 ♂♂, Todai, Kamiina, Nagano Pref., 7. vii. 1970, M. OWADA leg. (KMNHIR000, 197–198); 1 ♂, Kyoto, (ELKU); 1 ♀, Tera, Ina, Nagano Pref., 14–18. viii. 1971, M. OWADA leg. (KMNHIR000, 199); 1 ♀, Kyoto, (ELKU).

Distribution: China, Korea and Japan.

9-3. *Maliaattha arefacta* (BUTLER, 1879)

(Figs., 77, 78, 88–H)

Acontia arefacta BUTLER, 1879, *Ann. Mag. nat. Hist.* (5) 4: 366.

Lithacodia arefacta: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 502, pl. 163, fig. 30.

Maliaattha arefacta: WARREN, 1912, in Seitz Gross-Schmett. *Erde* 3: 277, t. 51 m.

Maliaattha arefacta: INOUE & SUGI, 1958, *Check List Lepid. Japan* 5: 543.

Maliaattha arefacta: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 814, 2: 382, pl. 197: 10–11.

Length of fore wing: 7–8 mm.

Frons white; vertex ochreous white, sometimes mixed with brown; labial palpus fuscous brown slightly mixed with ochreous white; 3rd segment ochreous white; antenna dark brown, slightly ringed with ochreous white basally. Thorax white with two ochreous brown bands on the anterior and middle portions; collar white with two ochreous brown bands at the middle; pleural area white; legs white mixed with brown; tarsi brown ringed with ochreous white. Abdomen brown mixed with ochreous; segmental lines ochreous white; dorsal crests on 1st to 4th segments; 1st ochreous white tipped with white; 2nd to 4th ochreous white basally, black at the middle and tipped with white apically.

Fore wing: White suffused with ochreous brown and dark brown; costa tinged with ochreous brown to the middle; subbasal line represented by dark brown spots on costa and discal cell; antemedial line indistinct; a broad white line defined by ochreous brown on inner side and dark brown on outer side, slightly sinuous below costa and angled

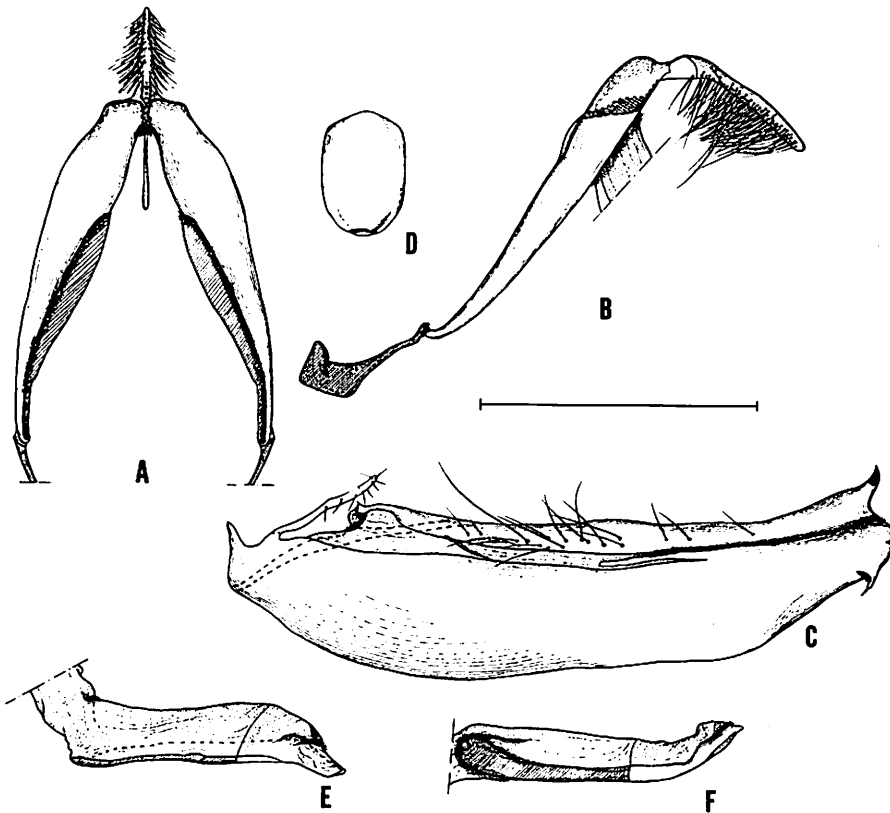


Fig. 77. Male external genitalia of *Maliaattha arefacta* (BUTLER).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. Scale 1 mm.

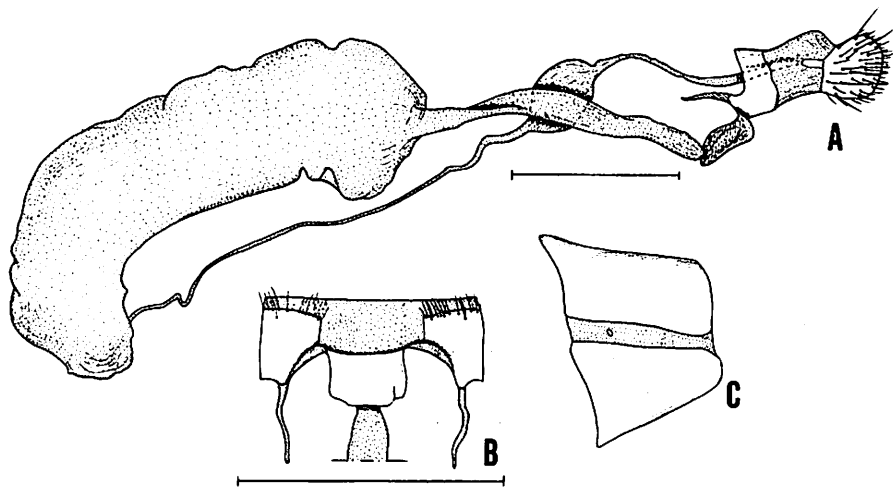


Fig. 78. Female genitalia and terminalia of *Maliaattha arefacta* (BUTLER).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). Scales 1 mm.

inwards almost straight below cell; orbicular and claviform stigmata absent; medial area ochreous brown; reniform stigma with white annulus, which is filled with dark brown and with an ochreous spot at the middle; a broad and white line, defined by dark brown on inner side, from the inner ventral portion of reniform, angled outwards to inner margin; postmedial line white, defined by ochreous brown on each side, angled outwards below costa to vein 7, incurved and minutely waved to reniform stigma and obsolescent; three white costal points beyond postmedial line; white and ochreous brown patches below costal points; postmedial area suffused with dark brown; in some specimens, the veins of this area with dark brown streaks, defined by white; subterminal line white, angled outwards at vein 7, excurved at the middle and slightly angled at the submedian fold; subterminal area suffused with ochreous brown; terminal line absent; cilia white with two dark brown lines through them.

Hind wing: White irrorated with dark brown; cilia ochreous white at the base; a dark brown line through them at the middle and more whitish apically.

Underside of fore wing: Dark brown; costal area tinged with ochreous white.

Underside of hind wing: White irrorated with dark brown; a discoidal spot and postmedial line dark brown; postmedial area darker; a terminal series of dark brown striae; cilia ochreous white, with a brown line through them at the middle.

Male external genitalia: Tegumen long, slender and deeply concaved middorsally; vinculum short, slender and almost $1/4$ as deep as tegumen; saccus rather deep and produced dorsally. Uncus slender, rather short, $1/2$ as long as tegumen, weakly sclerotized basally and ended in a rounded tip; ventral portion of uncus densely

long-haired; process of uncus long and thin. Valva long, 4.5 times as long as medially wide, and almost subequal through its length; costa narrow basally and almost straight; cucullus and harpe separated by membranous incision from anellifer, and fused with each other, narrowed apically; acute processes on its distal ends; sacculus long and broad, with a slender process dorsobasally. Juxta small, and almost elliptical. Phallus long and slender; sclerotized portion of suprazonal sheath narrow, gently curved ventrally; coecum not developed.

Female terminalia: Seventh abdominal segment tapering posteriorly.

Female genitalia: Eighth abdominal tergum well sclerotized; apophysis anterioris 1.5 times as long as 8th abdominal tergum; copulatory cavity small and evenly sclerotized ventrally. Ductus bursae rather long, 2/3 as long as corpus bursae. Ductus seminalis long, 2.5 times as long as ductus bursae, slender and bulged beyond the middle. Corpus bursae long; cervix bursae small. Signa absent. Papilla analis moderate, sparsely short-haired and with a rounded distal margin; apophysis posterioris long, 1.5 times as long as apophysis anterioris.

Specimens examined: [Taiwan] 1 ♀, Mt. Shihtoushan, Miaoli-Hsien, 11. vi. 1975, K. UEDA et K. SETOYA leg. (KMNHIR000, 200). [Japan] 1 ♂, Sakasamaki, Niigata Pref., 1. viii. 1960, H. MURAKI leg. (MURAKI Collection); 1 ♂, Mt. Oginosen, Hyogo Pref., 21. vi. 1972, M. OWADA leg. (KMNHIR000, 201); 1 ♂, Sasuna, Tsushima Is., Nagasaki Pref., 6. ix. 1973, K. UEDA leg. (KMNHIR000, 202); 1 ♂, Yona, Okinawa Is., Okinawa Pref., 18–21. x. 1973, M. OWADA leg. (KMNHIR000, 203); 1 ♂, Komi, Iriomote Is., Okinawa Pref., 24–26. x. 1973, M. OWADA leg. (KMNHIR000, 204); 1 ♀, Tochio, Niigata Pref., 5. viii. 1970, H. MURAKI leg. (MURAKI Collection); 1 ♀, Mt. Wakasugi, Fukuoka Pref., 3. vii. 1976, bred by K. UEDA (KMNHIR000, 205); 1 ♀, Arakawa, Fukuejima Is., Nagasaki Pref., 6. ix. 1974, Y. YOSHIYASU leg. (KMNHIR000, 206); 1 ♀, Kurio, Yakushima Is., Kagoshima Pref., 12. vii. 1970, K. TOBI leg. (KMNHIR000, 207).

Distribution: China, Taiwan and Japan.

9-4. *Maliattha vialis* (MOORE, 1882)

(Figs., 79, 80, 89-A)

Acontia vialis MOORE, 1882, in HEWITSON & MOORE, Descr. new Indian Lepid. Insects Colln late Mr. W. S. ATKINSON: 135.

Lithacodia vialis: HAMPSON, 1910, Cat. Lepid. Phalaenae Br. Mus. 10: 507.

Maliattha vialis: WARREN, 1912, in Seitz, Gross-Schmett. Erde 3: 276, 6. 51 m.

Maliattha vialis: INOUE & SUGI, 1958, Check List Lepid. Japan 5: 543.

Maliattha vialis: SUGI, 1982, In INOUE, H. et al., Moths of Japan 1: 815, 2: 383, pl. 197: 19–20.

Length of fore wing: 8–11 mm.

Head pale reddish brown; labial palpus reddish brown; 3rd segment tipped with ochreous; antenna dark brown ringed with pale brown. Thorax pale reddish brown; collar slightly mixed with brown; pleural area white; legs brown mixed with ochreous;

tarsi brown banded with ochreous. Abdomen brown mixed with ochreous, and with ochreous segmental lines; dorsal crests on 1st, 3rd to 4th segments; 1st pale reddish brown; 3rd to 4th black.

Fore wing: Pale olive-brown on costal, basal and medial areas; costa suffused with dark brown before the middle; rest of the wing dark brown suffused with purplish red and rufous; subbasal and antemedial line absent; a white line defined by dark brown on outer side, from the lower angle of cell and oblique to the inner margin; small wedge-shaped discoidal spot dark brown; postmedial line white, angled outwards below costa, excurved to vein 6, then defined by dark brown on inner side and minutely waved to vein 3 and sinuous to inner margin; the rest of the postmedial area darker; a triangular rufous patch below costa on postmedial area; subterminal line indistinct, waved and excurved below vein 7 and at the middle; subterminal area suffused with purplish red; a terminal series of dark brown striae; cilia dark brown suffused with purplish red.

Hind wing: Pale brown; terminal line brown; cilia ochreous white, with a brown stria

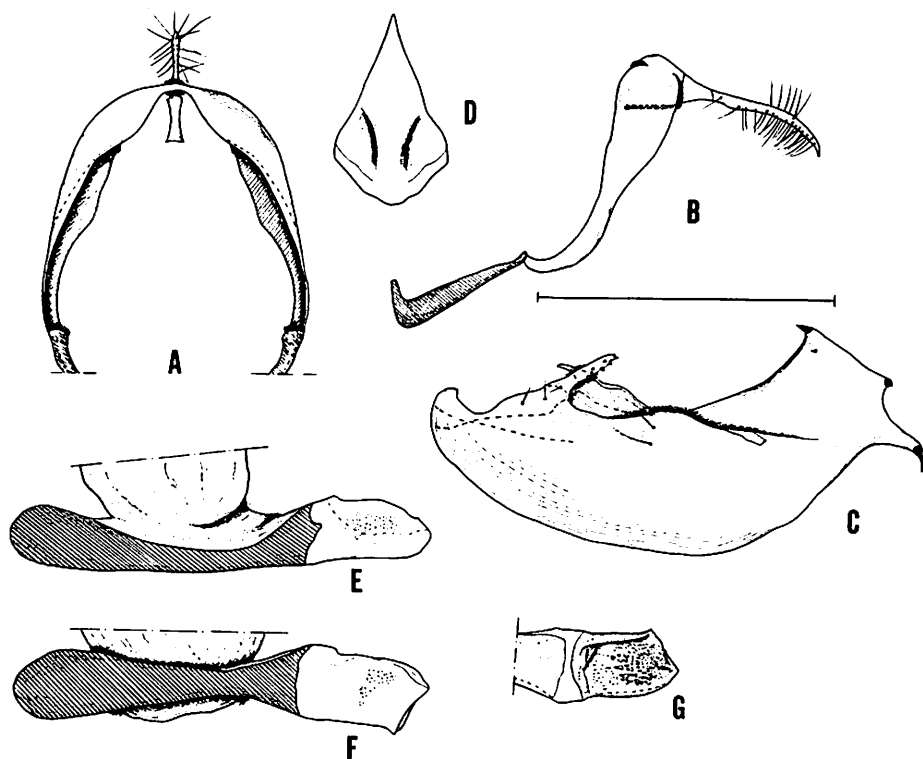


Fig. 79. Male external genitalia of *Maliattha vialis* (MOORE).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Juxta. E: Phallus in lateral view (left). F: Phallus in ventral view. G: Apical portion of phallus in dorsal view. Scale 1 mm.

before middle through them and slightly tipped with purplish red.

Underside of fore wing: Dark brown tinged with purplish red; costal area slightly tinged with ochreous; terminal series of dark brown striae; cilia dark brown, sometimes strongly suffused with purplish red at the apex, on the middle and on the tornus.

Underside of hind wing: White sparsely irrorated with brown; discoidal spot and postmedial line dark brown; a terminal series of dark brown striae; cilia ochreous with a faint dark brown line before the middle.

Male external genitalia: Tegumen moderate and very narrow dorsomedially; vinculum short, $1/2.5$ as deep as tegumen; saccus short, produced dorsally and ended in a truncated tip. Uncus very slender, long, $2/3$ as long as tegumen, weakly sclerotized basally, slightly curved ventrally beyond the middle and ended in a sharply pointed tip; ventral margin of uncus sparsely long-haired; process of uncus rather short, constricted at the middle. Valva short, 3 times as long as medially wide, almost subequal through its length and strongly curved dorsally; costa very narrow, sinuous and descending distally; cucullus + harpe strongly curved dorsally and ended in broad and truncated margin with acute processes distally; sacculus large and broad; its dorsal margin produced dorsally and

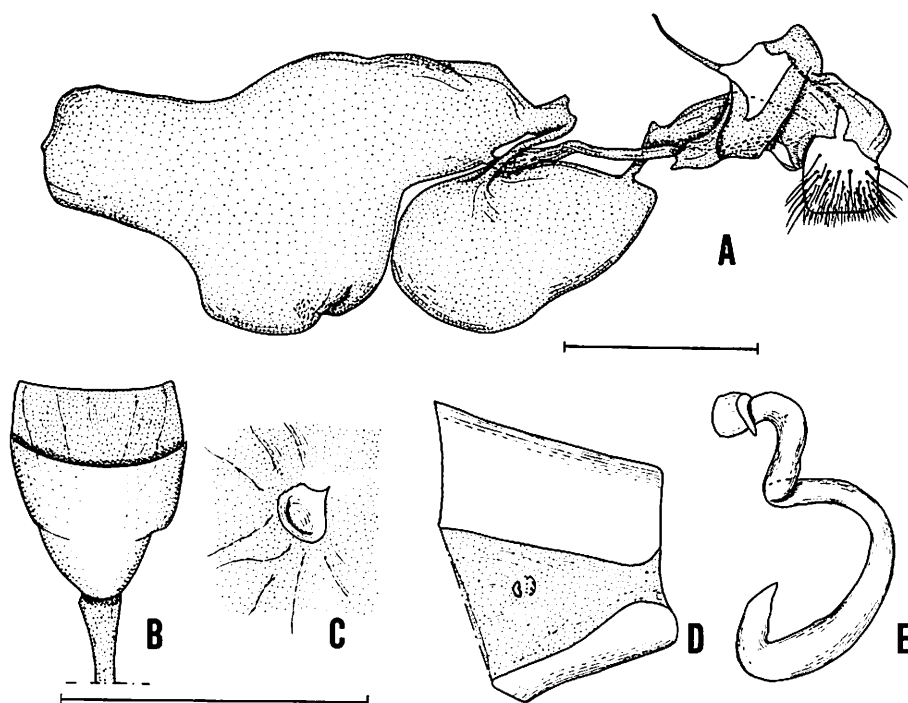


Fig. 80. Female genitalia and terminalia of *Maliaattha vialis* (MOORE).
A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Signum.
D: Female terminalia in lateral view (left). E: Spermatophore. Scales 1 mm.

reaching to costa, and with a slender process basally. Juxta moderate, broadly swollen ventromedially and tapering to its acute tip. Phallus short and straight; sclerotized portion of suprazonal sheath broad and with a narrow dorsal band near zone; minute spines near the opening of ductus ejaculatorius; subzonal sheath constricted at the middle; coecum short, 1/3 as long as subzonal sheath.

Female terminalia: Seventh abdominal segment tapering posteriorly; small depression just behind the 7th abdominal spiracle.

Female genitalia: Eighth abdominal tergum small; apophysis anterioris 1.5 times as long as 8th abdominal tergum; copulatory cavity broad and membranous. Ductus bursae slender, short and 1/2 as long as corpus bursae. Ductus seminalis long, 2 times as long as ductus bursae and greatly bulged at the middle. Corpus bursae large; cervix bursae short. Signa represented by small plate, which is concaved at the middle. Papilla analis almost quadrate and sparsely short-haired; apophysis posterioris slender and almost as long as apophysis anterioris; a ventromedial small plate on the membranous region between papillae anales.

Specimens examined: [Taiwan] 1 ♂ 1 ♀, Fenchihu, Chiai-Hsien, 18. vi. 1975, K. UEDA et K. SETOYA leg. (KMNHIR000, 208–209). [Japan] 1 ♂, Shionomata, Tōkamachi, Niigata Pref., 10. vi. 1972, R. SATO leg. (KMNHIR000, 210); 1 ♂, Ozino, Gifu Pref., 16. vi. 1976, H. ENDO leg. (KMNHIR000, 211); 1 ♂, Sasuna, Tsushima Is., Nagasaki Pref., 6. ix. 1973, K. UEDA leg. (KMNHIR000, 212); 1 ♂, Minami park, Fukuoka Pref., 1. vi. 1974, K. UEDA leg. (KMNHIR000, 213); 1 ♀, Mt. Akiba, Niigata Pref., 10. vi. 1960, R. SATO leg. (KMNHIR000, 214); 1 ♀, Mt. Inunaki, Fukuoka Pref., 6. vi. 1972, K. UEDA leg. (KMNHIR000, 215).

Distribution: India, China, Taiwan, Korea, USSR and Japan.

9–5. *Maliattha bella* (STAUDINGER, 1888)

(Figs., 81, 82, 89–B)

Thalpochares bella STAUDINGER, 1888, Stett. Ent. Zeit. 49: 264.

Maliattha vialis f. *bella*: WARREN, 1912, in Seitz, Gross-Schmett. Erde 3 : 276, t. 51 m.

Maliattha bella: SUGI, 1982, IN INOUE, H. et al., Moths of Japan 1: 815, 2: 383, pl. 197: 16–18.

Length of fore wing: 9–10 mm.

Head, thorax and abdomen almost the same as the former species *vialis*.

Fore wing: Also the same as *vialis* except for the following character-states: 1) medial, postmedial and subterminal areas suffused with reddish brown and purplish red and brighter than *vialis*, 2) subterminal line strongly excurved below vein 7 and at the middle, 3) subterminal area usually broader than *vialis*.

Male external genitalia: Tegumen broad; the dorsomedial portion of tegumen narrow and excavated at the posterior margin; vinculum rather broad, 1/2 as deep as tegumen; saccus rather deep and strongly produced dorsally. Uncus broad, short, 3/8 as long as

tegumen, ended in a truncated tip and sparsely long-haired apically; process of ucnus short and pointed at the tip. Valva short, 3 times as long as medially wide, and abruptly narrowed distally; costa broad and strongly produced dorsally near its base; cucullus + harpe short, narrow, strongly produced dorsally, bearing long, acute processes distally and with small spines ventrodistally; sacculus moderate, with short and broad process on the middle portion of its dorsal margin. Juxta large, swollen ventromedially and broadly excavated at the posterodistal margin. Phallus short and almost straight; sclerotized portion of suprazonal sheath moderate; minute spines near the opening of ductus ejaculatorius; subzonal sheath constricted at the middle; coecum small, $1/4$ as long as subzonal sheath.

Female terminalia: Seventh abdominal segment tapering posteriorly; posteroventral portion of 7th abdominal tergum produced ventrally and internally, and forming a concaved area at the posterior portion of lateral membranous region of the segment.

Female genitalia: Eighth abdominal tergum small; apophysis anterioris long, 2 times as long as 8th abdominal tergum; copulatory cavity small and membranous. Ductus bursae long, almost as long as corpus bursae. Ductus seminalis long, 2 times as long as ductus bursae and greatly bulged at the middle. Corpus bursae rounded; cervix bursae

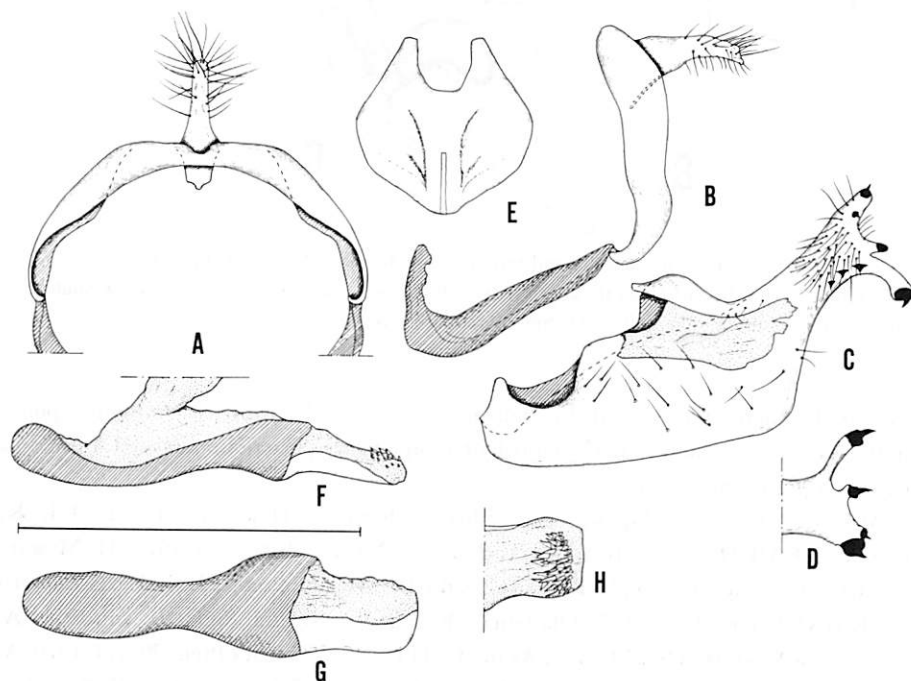


Fig. 81. Male external genitalia of *Maliaattha bella* (STAUDINGER).

A: Dorsum in dorsal view. B: Ring in lateral view (left). C: Right valva, inner view. D: Apical portion of left valva, inner view. E: Juxta. F: Phallus in lateral view (left). G: Phallus in ventral view. H: Apical portion of phallus in dorsal view. Scale 1 mm.

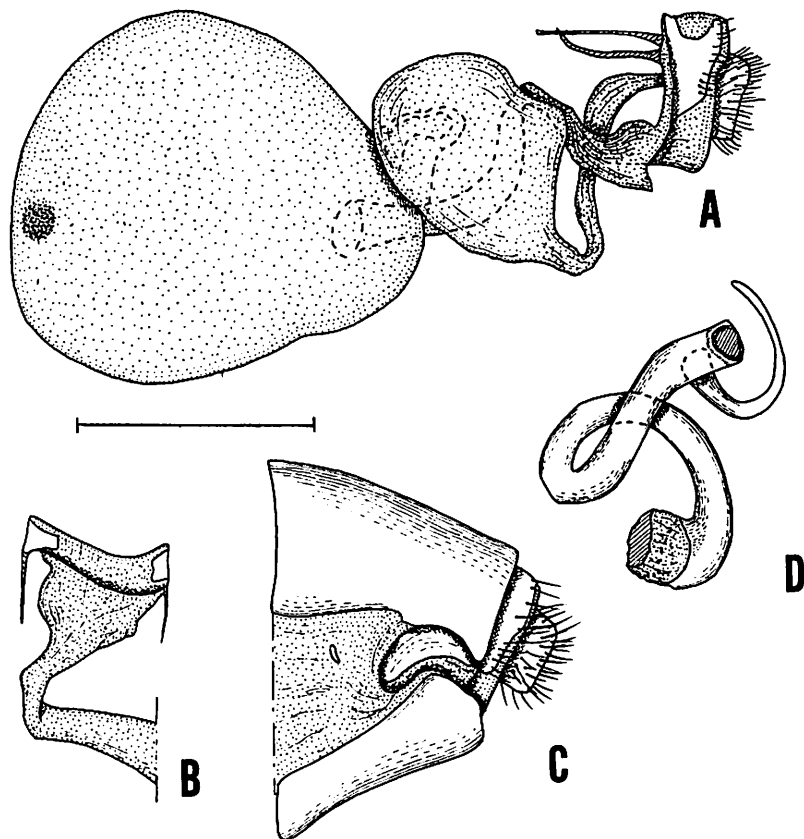


Fig. 82. Female genitalia and terminalia of *Maliaththa bella* (STAUDINGER).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Spermatophore. Scale 1 mm.

very small. Signa represented by indistinct small patch, with very minute spines. Papilla analis oblong and sparsely short-haired; apophysis posterioris almost 1.5 times as long as apophysis anterioris.

Specimens examined: [Japan] 1 ♂, Sibeche, Kushiro, Hokkaido, 1. viii. 1954, K. Iijima leg. (KMHIR000, 216); 1 ♂, Tochio city, Niigata Pref., 3. vi. 1970, H. MURAKI leg. (MURAKI Collection); 1 ♂, Tojigawa, Sado Is., Niigata Pref., 23. vii. 1963, R. SATO leg. (KMNHIR000, 217); 1 ♂, Okutainai, Kurokawa, Niigata Pref., 21. viii. 1971, A. SEINO leg. (KMNHIR000, 218); 1 ♂, Akatani, Shibata city, Niigata Pref., 29. viii. 1970, A. SEINO leg. (KMNHIR000, 219); 1 ♀, Akadani, Niigata Pref., 29. viii. 1970, R. SATO leg. (KMNHIR000, 220).

Distribution: USSR and Japan.

9-6. *Maliattha culta* (BUTLER, 1879)
(Figs., 83, 84, 89-C)

Narosa culta BUTLER, 1879, *Ann. Mag. nat. Hist.* (5) 4: 356.

Eustrotia culta: HAMPSON, 1910, *Cat. Lepid. Phalaenae Br. Mus.* 10: 603, pl. 166, fig. 29.

Unca culta: INOUE & SUGI, 1958, *Check List Lepid. Japan* 5: 547.

Inabaia culta: SUGI, 1982, In INOUE, H. et al., *Moths of Japan* 1: 819, 2: 384, pl. 197: 58.

Length of fore wing: 10-11 mm.

Frons and vertex brown tinged with pink and pale white; labial palpus dark brown mixed with pink; antenna brown with pale ochreous scales dorsally. Thorax pinkish brown mixed with dark brown; tegula and posterior portion of thorax whitish; plueral area white; legs dark brown mixed with ochreous and pink; tarsi dark brown slightly banded with ochreous. Abdomen fuscous with ochreous white segmental lines; ventral and

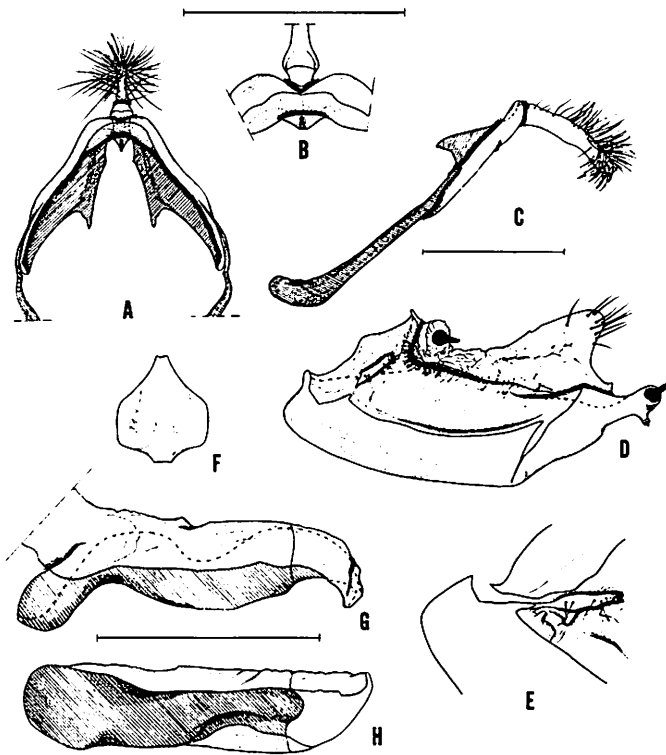


Fig. 83. Male external genitalia of *Maliattha culta* (BUTLER).

A: Dorsum in dorsal view. B: Posterior portion of dorsum in dorsal view. C: Ring in lateral view (left). D: Right valva, inner view. E: Basal portion of saccus, showing a slender process from the dorsal margin of saccus. F: Juxta. G: Phallus in lateral view (left). H: Phallus in ventral view. Scales 1 mm.

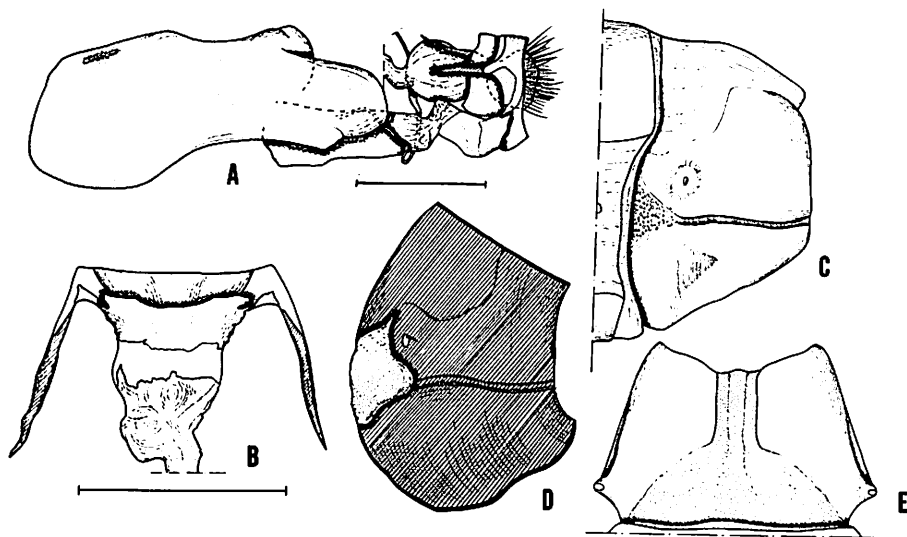


Fig. 84. Female genitalia and terminalia of *Maliaatha culta* (BUTLER).

A: Whole genitalia in lateral view (left). B: Ostium in ventral view. C: Female terminalia in lateral view (left). D: Inner region of 7th abdominal tergum and sternum (part), showing a gland-like organ between them. E: Seventh abdominal tergum in dorsal view. Scales 1 mm.

caudal portions of abdomen whitish; dorsal crests on 2nd to 4th segments, white and tipped with black.

Fore wing: Pink; subbasal line represented by a series of dark brown spots from costa to discal cell; antemedial line broad and pink, defined by olive-brown on inner side and angled outwards from costa to inner margin; the apical portion of antemedial line irregularly dilating; medial area uniformly olive-brown; a series of dark brown spots near its outer margin; reniform with pink annulus, oblique and constricted at the middle; a broad and pinkish white line from the lower angle of cell and angled outwards to inner margin; postmedial line indistinct; a dark brown patch beyond the discocellular and its outer margin excavated at the middle; postmedial area suffused with pinkish white; subterminal line defined on inner side by olive-brown patch from costa to vein 4, then by pinkish white suffusion to inner margin; subterminal area pink; terminal line slender and dark brown; cilia pinkish brown, sparsely tipped with dark brown apically.

Hind wing: White irrorated with golden brown; a terminal series of dark brown striae; cilia ochreous white and tipped with pink.

Underside of fore wing: Brown; costal area tinged with ochreous and subterminal area with pink.

Underside of hind wing: Ochreous white, sparsely irrorated with dark brown; a dark brown discoidal spot and faint postmedial line.

Male external genitalia: Tegumen slender and moderate; dorsomedial portion of

tegumen very narrow and excavated at the posterior margin; in lateral view, ventral margin of tegumen projected dorsally beyond the middle portion of tegumen and ended in a pointed tip; vinculum long, and almost $5/4$ as deep as tegumen; saccus moderate, and with a rounded distal margin. Uncus broad, long, as long as tegumen, well sclerotized, gently curved ventrally, ended in a truncated tip and densely long-haired apically. Valva short, 2.5 times as long as medially wide and broad; costa broad and strongly sclerotized; the basal portion of costa strongly produced dorsally, and with a large and acute process; harpe well sclerotized, tapering to apex, which is bearing large dorsal process and small mid and ventral processes; ampulla broad and strongly swollen dorsally; sacculus long, $2/3$ as long as valva, and bearing a slender and weakly sclerotized process on its dorsobasal margin. Juxta almost quadrate and tapering posteriorly. Phallus short, and almost straight; suprazonal sheath very short, strongly curved ventrally, tapering to pointed tip and concaved ventromedially near zone; coecum small, $1/4$ as long as subzonal sheath.

Female terminalia: Dorsomedial portion of 7th abdominal tergum broadly membranous, especially on its anterior half; anteroventral portion of 7th abdominal tergum swollen laterally and with a spiracle at the tip; ventrolateral portion of 7th abdominal tergum and the sternum completely fused with each other; a narrow groove present on this fused portion, with many minute spines anteriorly; inner side of this spine-bearing portion, with a large gland-like membranous organ.

Female genitalia: Eighth abdominal tergum with a large membranous incision on the anteroventral portion; apophysis anterioris moderately broad and as long as 8th abdominal tergum; copulatory cavity broad, deep and well sclerotized ventrally. Ductus bursae broad, short and $1/2$ as long as corpus bursae. Ductus seminalis slender and almost as long as ductus bursae. Corpus bursae large; cervix bursae rather long and $1/3$ as long as corpus bursae. Signa represented by indistinct minute spines. Papilla analis densely long-haired with produced distal margin; apophysis posterioris 1.5 times as long as apophysis anterioris.

Specimens examined: [Japan] 1 ♂, Miki, Hyōgo Pref., 4. ix. 1972, M. OWADA leg. (KMNHIR000, 221); 1 ♂, Mt. Hikosan, Fukuoka Pref., 17. viii. 1933, T. ESAKI leg. (ELKU); 2 ♂♂, Tamarai, Ōita Pref., 28. viii. 1930, C. TAKEYA leg. (ELKU); 1 ♀, Miki, Hyōgo Pref., 4. ix. 1972, M. OWADA leg. (KMNHIR000, 222); 1 ♀, Mt. Hikosan, Fukuoka Pref., 17. viii. 1933, T. ESAKI leg. (ELKU); 3 ♀♀, Arakawa, Fukuejima Is., Nagasaki Pref., 6. ix. 1974, Y. YOSHIYASU leg. (KMNHIR000, 223–225).

Distribution: China, Korea and Japan.

Remarks: As already mentioned in the above description, *culta* is specialized in many respects and they are summarized as follows; 1) ventral margin of tegumen projected dorsally beyond the middle portion of tegumen, 2) costa with a large and acute process, 3) 7th abdominal tergum of female broadly membranous dorsomedially and 4) ventrolateral portion of 7th abdominal tergum completely fused with 7th abdominal sternum in female. SUGI (1982) indicated these peculiar character-states in male external

genitalia and erected the genus *Inabaia* for *culta*. However, the following character-states; the process from uncus present, dorsum greatly narrowed and elongated, slender and weakly sclerotized process present on the dorsobasal margin of sacculus, probably indicate the relationship between *culta* and other species of the genus *Maliattha*, although *culta* is regarded as rather isolated species. Therefore I tentatively include *culta* into the genus *Maliattha* in this paper.

9-7. Phylogenetic relationships in the genus *Maliattha* (Fig. 85).

Six species; *signifera*, *rosacea*, *arefacta*, *vialis*, *bella* and *culta* are included in the genus *Maliattha* in this paper. The genus *Maliattha* is characterized by the following autapomorphies; process of uncus present, muscle 1 inserted on the process of uncus, muscle 8 originated from the middle of vinculum, and slender process present on the dorsobasal margin of sacculus. Five monophyletic subgroups: the *culta*-, the *signifera*-, the *rosacea*-, the *arefacta*- and the *vialis*-subgroups are recognized. The autapomorphies, interspecific relationships of each subgroup and the phylogenetic relationships among the subgroups are discussed as follows.

(1) the *culta*-subgroup: This subgroup consists of *culta*. It is characterized by many autapomorphies as already mentioned in the remarks of 9-6, 1)-4).

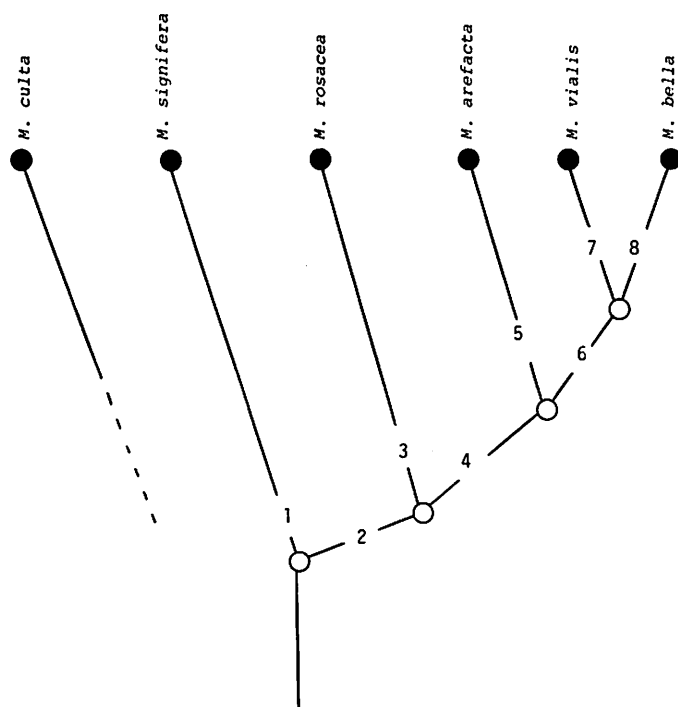


Fig. 85. Inferred phylogenetic relationships in the genus *Maliattha*.

(2) the *signifera*-subgroup: This subgroup consists of *signifera*. It is characterized by the following two autapomorphies; large and asymmetrical ampullae developed, and ventral portion of subzonal sheath with membranous incision near zone (Fig. 85-1).

(3) the *rosacea*-subgroup: This subgroup consists of *rosacea*. It is characterized by the following autapomorphy; club-like process from the sacculus reduced (Fig. 85-3).

(4) the *arefacta*-subgroup: This subgroup consists of *arefacta*. It is characterized by the following two autapomorphies; 5th and 6th lines run inwards to inner margin, and terminal line absent (Fig. 85-5).

(5) the *vialis*-subgroup: This subgroup consists of *vialis* and *bella*. It is characterized by the following two autapomorphies; reniform stigma with a small wedge-shaped discoidal spot, and a median white oblique line from the lower angle of cell to inner margin (Fig. 85-6). *M. bella* is more specialized than *vialis* in bearing the concaved area of posteroventral portion of female 7th abdominal tergum, and apical portion of cucullus + harpe abruptly narrowing distally.

(6) the phylogenetic relationships of the 5 subgroups. Among the 5 subgroups, *rosacea*-, *arefacta*- and *vialis*-subgroups compose the monophyletic group which has a sister-group relationship with *signifera*-subgroup. These 3 subgroups are plesiomorphic in bearing no ampulla, while they share the following synapomorphy; large acute processes on the distal margin of cucullus + harpe (Fig. 85-2). On the other hand, *signifera*-subgroup is rather plesiomorphic in this character-state. The *arefacta*- and *vialis*-subgroups form a monophyletic group based on an synapomorphy that anellifer narrowed and not produced ventrally (Fig. 85-4). The *rosacea*-subgroup is retained in plesiomorphic with anellifer. The *culta*-subgroup is rather isolated one as already mentioned in 9-6.

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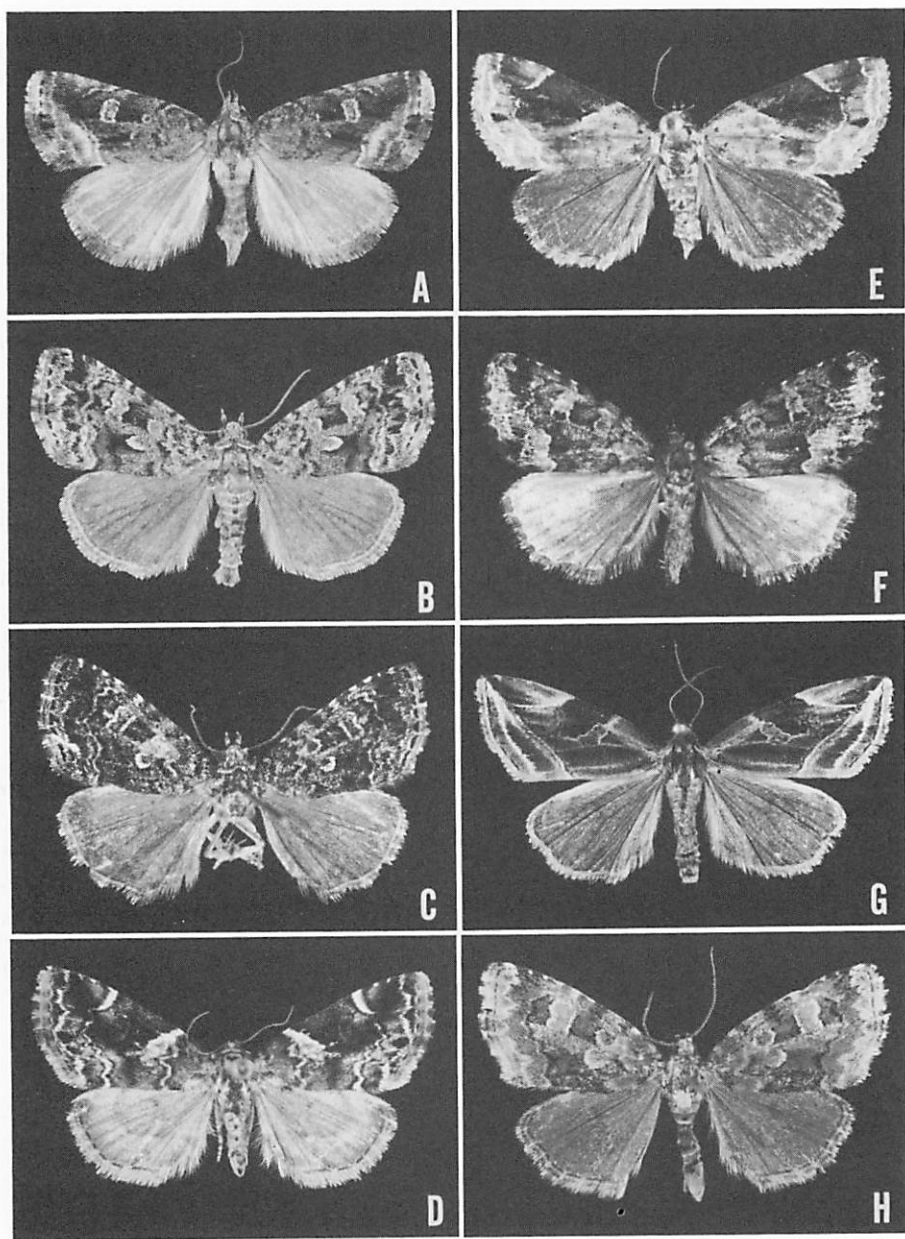


Fig. 86.

A: *Protodeltote wiscottii* (STAUDINGER); female; Japan. B: *Protodeltote distinguenda* (STAUDINGER); male; Japan. C: *Protodeltote inexpectata* sp. nov.; male, holotype; Japan. D: *Pseudodeltote coenia* (SWINHOE); male; Taiwan. E: *Pseudodeltote subcoenia* (WILEMAN and SOUTH); female; Taiwan. F: *Pseudodeltote formosana* (HAMPSON); male; Taiwan. G: *Micardia pulchra* BUTLER; male; Japan. H: *Koyaga numisma* (STAUDINGER); male; Japan.

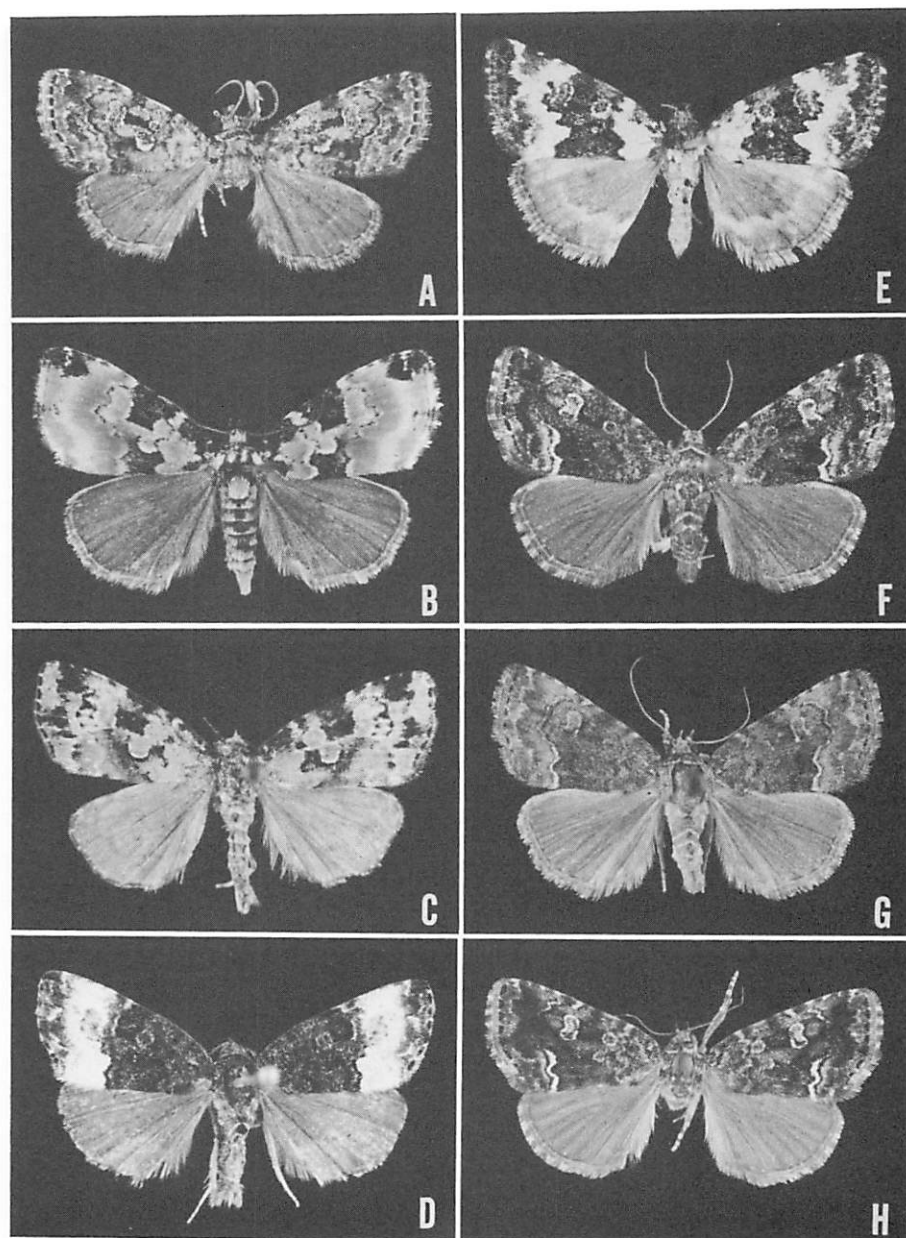


Fig. 87.

A: *Koyaga virescens* (SUGI); male; Japan. B: *Koyaga senex* (BUTLER); male; Japan. C: *Koyaga viriditincta* (WILEMAN); male; Taiwan. D: *Deltote nemorum* (OBERTHÜR); male; Japan. E: *Deltote deceptor* (SCOPOLI); male; Europe. F: *Sugia stygia* (BUTLER); male; Japan. G: *Sugia elaeostygia* (SUGI); male; Japan. H: *Sugia rufa* sp. nov.; male, holotype; Japan.

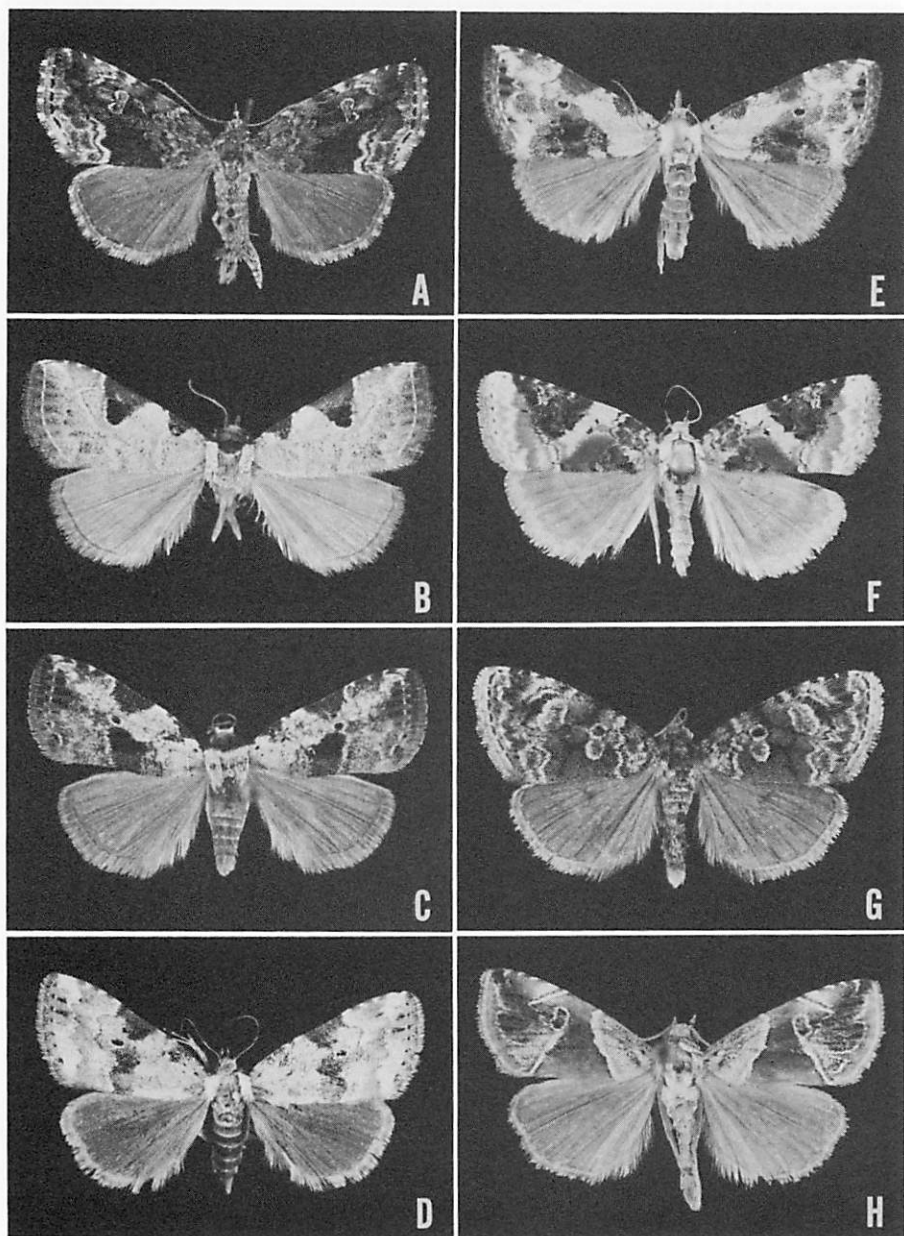


Fig. 88.

A: *Sugia stygiodes* (SUGI); male; Japan. B: *Neustrotia costimacula* (OBERTHÜR); male; Japan.
 C: *Neustrotia rectilineata* sp. nov.; male, holotype; Taiwan. D: *Neustrotia sugii* (TANAKA);
 female; Japan. E *Neustrotia noloides* (BUTLER); male; Japan. F: *Pseudeustrotia candidula*
 (DENIS and SCHIFFERMÜLLER); male; Japan. G: *Maliattha rosacea* (LEECH); male; Japan.
 H: *Maliattha arefacta* (BUTLER); male; Japan.

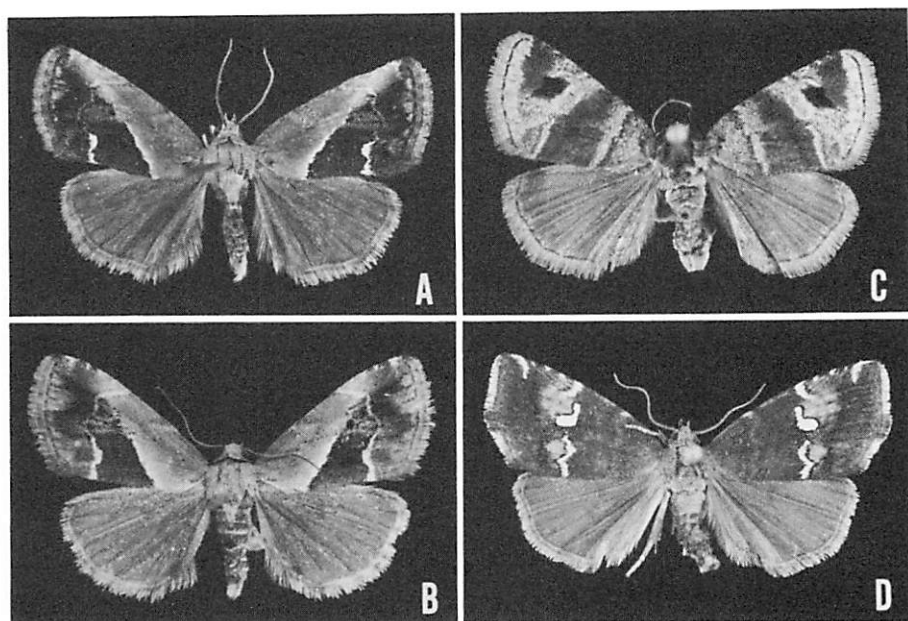


Fig. 89.

A: *Maliaattha vialis* (MOORE); male; Japan. B: *Maliaattha bella* (STAUDINGER); female; Japan.
C: *Maliaattha culta* (BUTLER); male; Japan. D: *Erastoides fentoni* (BUTLER); male; Japan.